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This Week in The IRON AGE

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Ninetieth Annual Review Issue

Editorial

Private vs. Public Employment ... 45

Technical Articles

Industry, 1944-1945 ... 48
Steel ... 54
War Production ... 60
Nonferrous Metals ... 64
Ferrous Metallurgy ... 68
Nonferrous Metallurgy ... 72
Transportation ... 76
Welding ... 82
Machine Tools ... 86
Foundry ... 90
Metal Finishing ... 96
Export ... 100
Ore and Coal ... 104
Scrap ... 108
Reconversion ... 112
Prices and Production ... 118
- Steel Ingot Production ... 119
- Pig Iron Production ... 120
- Pig Iron Composite Prices ... 121
- Coke Prices ... 121
- Ore Prices ... 121
- Pig Iron, District Prices ... 148
- Steel Pipe Prices ... 152
- Tool Steel Prices ... 152
- Stainless Steel Prices ... 152
- Sheet and Plate Prices ... 154
- Strip Prices ... 158
- Galvanized Steel Prices ... 158
- Tin Plate Prices ... 160
- Bar Prices ... 162
- Wire Prices ... 162
- Shapes Prices ... 162
- Scrap Composite Prices ... 164
- Scrap, Grade and District Prices ... 164
- Ferroalloy Prices ... 168
- Nonferrous Metals Prices ... 170

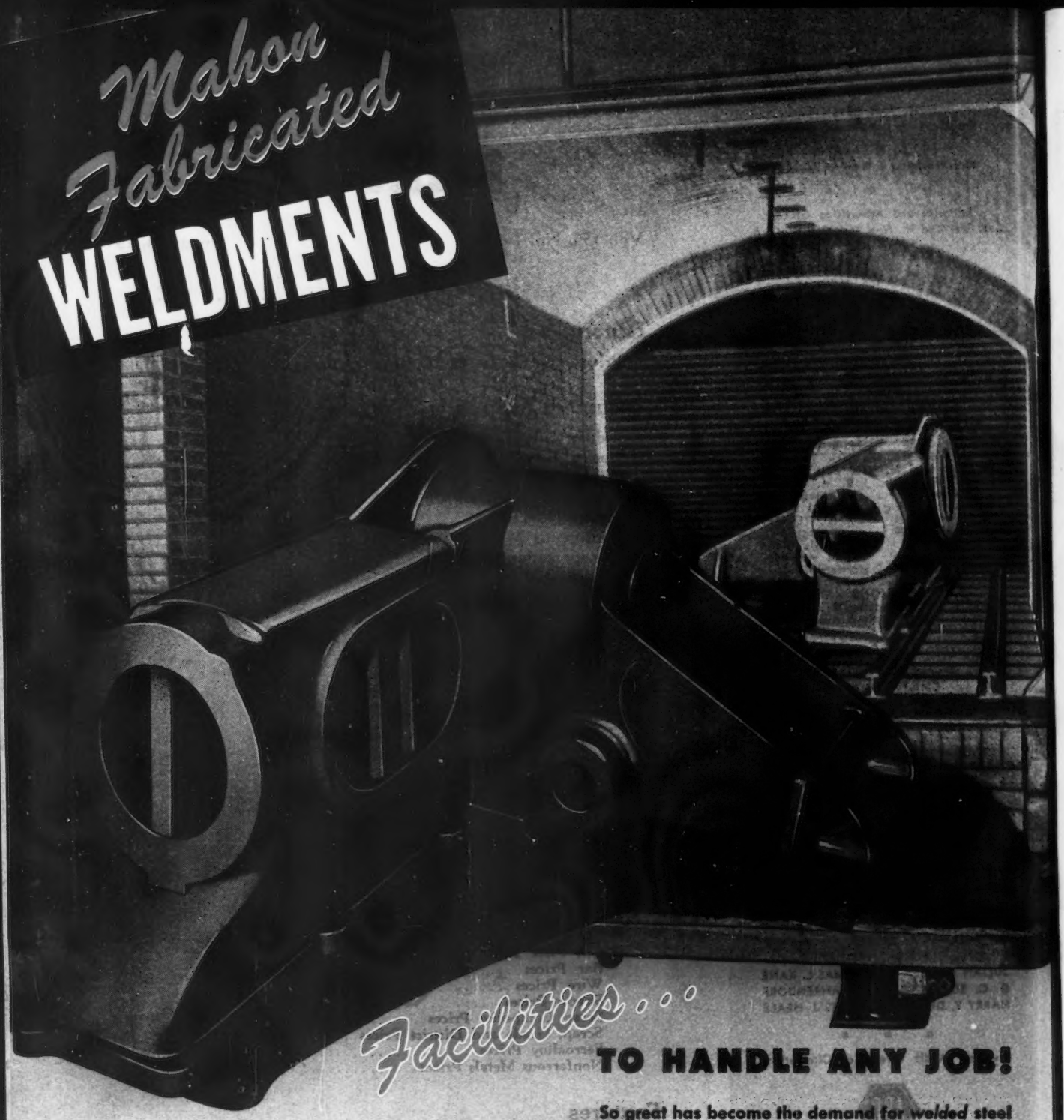
Features

News Front ... 47
Assembly Line ... 124
Washington ... 128
West Coast ... 132
Personals and Obituaries ... 136
Dear Editor ... 138
This Industrial Week ... 140
News of Industry ... 143

News and Markets

Iron and Steel Scrap News and Prices ... 194
Comparison of Prices by Week and Year ... 197
Machine Tool Market Developments ... 198

Index to Advertisers ... 293



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So great has become the demand for *welded* steel plate construction—so complex and diversified the nature of parts and fittings to be fabricated—only those plants with long and varied experience—and with the essential skill and equipment—can qualify successfully in meeting today's requirements. Mahon occupies a foremost position in this highly specialized field. Flame cutters, saws, power brakes, automatic welding machines, positioners, annealing furnaces, sand blasting equipment, X-ray testing apparatus, etc.—all necessary to the handling, shaping and fabricating of large production steel plate work—are in the hands of experienced operators. In addition, our DESIGN ENGINEERING SERVICE is at your complete disposal in helping you determine whether your product is adaptable to *welded* steel plate construction—and, if so, in assisting you in re-designing it, when required.

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The
IRON AGE

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Private vs. Public Employment

IF you are "able and willing to work," in the postwar world there should be a job waiting for you, according to the thinking of our modern political economists. There are provisos, however, that are never mentioned because they would not be politically popular. These are: "Provided the work you are capable of doing fills a need; provided the pay you receive for it is commensurate with the service rendered, and provided some employer creates the necessary employment.

There are just two kinds of employers to whom you can look for work, private and public. It has been promised that if private employers cannot make jobs for everybody, then the public employer, namely Uncle Sam, will.

Private employers in America have had the most experience in creating and maintaining employment, having previous to the war provided 85 to 98 per cent of all available jobs, good times and bad. Private employers pay better wages all along the line for work they want done than does the public employer in spite of the fact that they have to be self-liquidating in their operations whereas the government creates employment by liquidating the taxpayers.

Private employers have manufactured employment or jobs at a profit. Government almost invariably does so at a loss. Even during the 10-year pre-war period, 1930-40, public debt increased 75 per cent while private debt was reduced 25.5 per cent in the same period.

Private employers have not only created more and better employment than has the government and made it while reducing its burden of debt, but they have better served the public while so doing as measured by prices charged for goods and services. For during the same 10-year pre-war period they reduced the cost of goods purchased by wage earners and low salaried workers by 19 per cent* while government increased the cost of its services to the public by 74.9 per cent.

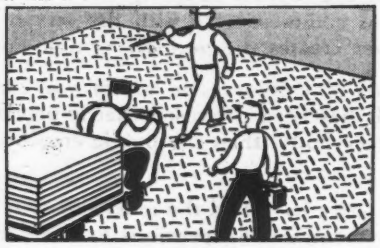
When government undertakes to create employment, not having to make ends meet or to meet competition, its tendency is to create it by putting two men to do one man's work or to put men to work at unnecessary jobs. That is an easy way to make jobs, but it is hard on the taxpayers. It reminds me of the story of the two chaps who invented a stove polish and a soap that was the only solvent that would remove the stain of the polish from the customers' hands. One partner made the rounds selling the polish and the other followed him two days later selling the soap. It made two jobs out of one, but was hard on the customers.

If government wants to or has to take a hand in creating postwar employment, the best way it can do so is to slip a couple of aces in the form of tax and regulation relief into the private employer's deck and then sit back and watch him go to town. As the philosopher put it: "Let them does it as knows how."

When it comes to creating jobs, Uncle Sam is a good kibitzer but a second-rate money player.

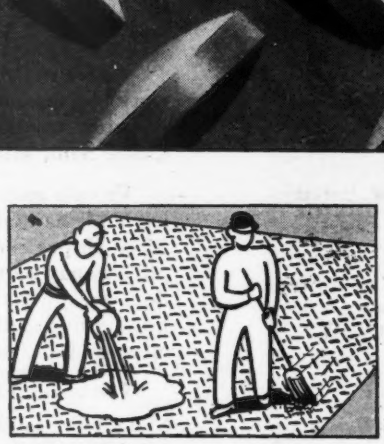
*Statistical Abstract of the United States, 1942, Table 399, page 377.

FOUR REASONS FOR USING INLAND 4-WAY FLOOR PLATE



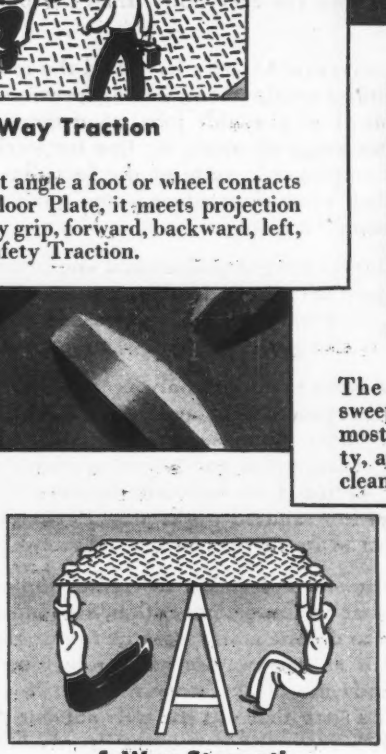
4-Way Traction

No matter at what angle a foot or wheel contacts Inland 4-Way Floor Plate, it meets projection edges which safely grip, forward, backward, left, right—4-Way Safety Traction.



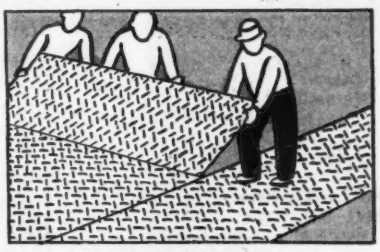
4-Way Drainage and Cleaning

The special Inland 4-Way pattern permits sweeping and drainage in whatever direction is most convenient, clean floors contribute to safety, and Inland 4-Way Floor Plate makes shop cleanliness easier.



4-Way Strength

Inland Floor Plate is made of high quality open hearth steel. It has the tensile, compression and bend strength of structural steel plates. Its wear resisting qualities are far greater than other floor coverings.



4-Way Matching

The Inland pattern is the same in all four directions. Plates can be matched end to end, side to side, or side to end, to provide a continuous and pleasing appearance. Pieces, even small ones, can be matched in and used with practically no waste.

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The IRON AGE
January 2, 1945

NEWS FRONT

► Loss to Germany of Nikopol, the Balkans and Hungary has reduced its 1943 supply of about 350,000 tons of contained manganese to a maximum yearly rate of approximately 70,000 tons.

Being cut off from the Petsamo nickel mines has left Germany with a yearly output of 1000 tons, principally from Norway, which is equivalent to little more than 10 per cent of Germany's 1943 supply.

Two-thirds of Germany's sources of molybdenum have been eliminated. These are Finland, Greece and Yugoslavia. Norwegian mines, an additional source of molybdenum have been bombed.

► In the United States, primary aluminum production reached about 750,000 net tons this year while secondary aluminum ingot produced from scrap amounted to approximately 300,000 tons.

The secondary aluminum ingot makers can look to a market running as high as 500,000 tons a year when manpower problems are solved. Determining factor will be price. But with high grade bauxite stocks dwindling, thus tending to raise costs of primary metal production, and with less rigid specifications for many civilian products, the secondary aluminum industry bids fair to win wider attention and benefit the nation through conservation of resources at the same time.

► Widespread use of gas turbines for power will be the inevitable result of the growing pressure for higher railroad speeds and more economical operations. One railroad is actually getting experimental results with a direct drive steam turbine.

► Little immediate premium is seen for the use of lightweight materials in new automotive designs. Present car speeds are adequate for existing roads. When better roads are available, light metals may be brought into the picture particularly if the price of aluminum is reduced.

► Freight car demand to make up the wartime backlog will be approximately 70,000 cars annually for five years and about 55,000 cars thereafter to handle a 1929 volume of business. This estimate assumes that the roads will maintain a 20 per cent improvement in utilization.

As for locomotives, estimated necessary replacement policies would call for about 1270 locomotives per postwar year until the war lag is made up, after which a normal retirement requirement of about 1050 units a year would have to be made to handle a 1929 volume of business.

► Many foundries are turning to mechanized operations because of the severe manpower shortage. These start at the yard when pig iron, scrap, sand and other raw materials are handled through the melting, annealing and cleaning departments to the shipping floor.

To reduce manpower to a minimum and entirely eliminate the hard physical labor generally associated with charging operations complete mechanical charging systems have been designed.

► Steel production this year reached an all-time record of 89,500,000 net tons that will probably not be equalled for some time. Finished steel production reached 63,846,000 tons.

Changing battlefronts in Europe has resulted in an increase of ammunition steel requirements from about 300,000 tons a month in November, 1944, to an extended program of 560,000 tons a month in March, 1945.

► Cause for the comeback of steel companies in seeking price relief from the Office of Price Administration has been, in addition to the wage rise recently granted, the cutback during the middle of 1944 of profitable war items.

► Steel mill facilities will be crowded to capacity during the early months of 1945. The estimate of 16,519,000 tons of carbon and alloy steel for the fourth quarter of 1944 is expected to hold good for the first two quarters of 1945.

Public anticipation of a sharp drop in war production when Germany is defeated is unfounded. An estimate of steel requirements for the first and second quarters of 1945 prepared a short time ago listing demand on a two-war and one-war basis indicated a war demand drop in the one-war estimate of only one million tons quarterly in carbon steel and 500,000 in alloy steel.

"It says here, Stell, that after the war all you'll have to do is press a button."

(Permission The New Yorker. Copyright The F-R Publishing Corp.)

1944-1945

War has preëmpted the spotlight from alluring postwar visions of the Elysian fields. Meanwhile, amid frustrated recriminations and the gray maze of economics and politics, the casting about for harsh blacks and whites goes on with about the usual resolution.

By T. W. Lippert

THAT first year of war had its emotional stimulus in an unprecedented industrial challenge. The second year rode along on the wave of demonstrable achievement. The third year—1944—was the so-called industrial "close-out" year, the year of world-wide military exploits and a welter of postwar statistical castles at home paced by softening production indexes.

But the 1944 "close-out" year refused to close out. The two great tyrannies with understandable fury refused to die. And, as all the statisticians at home transposed their late 1944 ordinates over into mid-1945, the war became a sodden affair of blood rather than a neatly extrapolated curve on a reconversion chart.

Industry in 1944, as mirrored by its advertisements, shifted from a boldly colored "Zowie-look-how-my-products-are-winning-the-war" theme to pastel pictures of inventive mechanization astride the blooded steed of competitive free enterprise, straining at the post to be off to succor American womanhood from all toil in general and irritating war hardships in particular. Hers is to be the plexi-glass future, the electronic kitchen in the jet-propelled housemobile carried safely along the bosom of radar, automatically timed, and requiring only so casual a drop of vitamin-fortified oil between trips to the psychiatrist.

This theme, with its four-color-bleed nuances, was stimulated by the bold cubism of economists, both reputable and pseudo. There is a deadly fascination in some $40,000,000,000 of cashable war bonds, unequalled bank deposits, and currency in circulation soaring above the fantastic $25,000,000,000 mark, all in juxtaposition with a three-year liquidation of consumer goods. On this monetary distortion has been erected the apex of an ever-expanding *a priori* economic pyramid, with so-many cashed bonds supporting so-much purchasing, which produces so-much national income, which creates so-many jobs, which returns so-much taxes, which services and refunds so-much debt, releasing so-much purchasing power, which, etc. Without a base there can be no truncation of the pyramid. But, the picture persistently brings to mind the awe of the Frenchman who, on seeing the splendiferously magnificent uniform of a Lord High Admiral, remarked, "Mon Dieu, quelle responsabilité!"

While this 1944 emotional escapism from war is at the moment in disfavor proportionally with the German military resurgence, its popularity rested on a broad base of general indifference as regards desirable but superimposed social and economic war aims (the only real war aim, frequently lost sight of, is to conquer or be conquered). Coupled with this indifference was unpopular or misinterpreted intelligence as to the Germans' war potential, genuine concern in all quarters (and also the concern of self-interest) as regards the social and economic imperativeness of rapid reconversion, obvious necessity for cushions against demobilization shocks, and intense journalistic pressure along with actual and potential Congressional strictures leveled at military over-planning. War-first civilians won out in a WPB upheaval only by the narrowest of margins, and even such an "elder statesman" as Baruch emphasized the critical urgency of immediate and widespread activation of reconversion plans, even though in 1918 he had said that a nation should plan in war as if it were to go on indefinitely. This latter sentiment, always a private conviction of WPB's Krug, has just been publicized as current policy.

But the new industrial war commitments impose no technical or production burdens on the metals industry comparable to those of 1943. They merely delay the period of general industrial reconversion and assure that shortages of certain civilian items for the first time may actually, rather than emotionally, approximate the "total war" scarcities so typical of all the other warring nations.

The dulling of the German punch and the first good Allied war news will find postwar reconversion topics again in full flower and the many factors involved unaltered. The financial and political trends in the shadowy period of industrial readjustment, with their counterpoint of Federal and business bureaucracies and encroachments of the state in the internal and international economic domain, will weave the fabric of industrial health. In just what degree the future economy will be based on both governmental planning and free enterprise depends on the interplay of variables still in a state of flux, but if past events are any criteria the coming pattern will evolve from a makeshift of compromise. However, the paradoxes of this unfolding pattern are well worth a quick scrutiny.

Just about everybody has got in his lick at compounding postwar panaceas—conservative business associations, individuals, Ivy-League economists, CIO, and the President with his work-budget of 60,000,000 postwar jobs. It's all relatively safe enough. Nobody holds a grudge against the maker of a rosy estimate, and in fact, few people will remember what the estimate was. Only the memory lingers that so-and-so was a person of stimulating imagination, who had painstakingly accumulated a great deal of data and was intensely interested in industrial and economic progress, and had formulated some very lucid ideas about the postwar situation.

In setting up their target for tomorrow the bulk of prognosticators

had hit on V+2, or 1947, as the year of postwar "normalcy." Brookings Institute has set a national income for that year of $127 billion; Harvard's Slichter likes a figure around $130 billion; G. M.'s Sloan hits on $125 billion; Ruml and the C. E. D. agree on $140 billion; Federal Reserve hits on $170 billion; the State Department toys with $150 billion; and miscellaneous spokesmen came up with anything from $100 billion to $200 billion. Since most liberals believe that an income of $130 billion will be required to support prewar employment as well as accommodating the increase in population and the very modest increase in man-hour productivity, the other estimates contemplate a future varying from a sub-standard way of life to a down-right riotous existence.

There is some evidence that all the postwar projections are in closer "secondary" agreement than their gross figures would indicate. Most are incorporating in their estimate a different hidden devaluation of the real value of the dollar. Ruml and C. E. D. are believed to be figuring on 30 per cent depreciation, which brings their $140 billion estimate theoretically in close accord with Sloan's undepreciated $125 billion. The practical aspect, however, is that if Ruml's dollar depreciates, so does Sloan's.

This factor of dollar depreciation is the flaw in the pyramid. Some depreciation has already occurred, and many a man, in and out of industry, is in sympathy with the theory that only through modest dollar depreciation can the higher entrenched material and labor costs be sustained, and a logical method devised for servicing the debt. Here, on this issue of somewhat questionable character seems to be at least one point of agreement between government and a portion of industry.

Debtors are conditioned psychologically for inflation, and it would only be natural that the sentiment should increasingly flourish in Washington to thus ease the Treasury's problem of debt repayment through partial repudiation, not in "dollars" but in terms of real purchasing power.

Inflation, even of the modest kind, is pretty much economic pablum, however. The high dollar value is representative of no net increase of real goods production and the findings graphed in Figs. 2 and 3 rapidly lose significance. The remarkable correlation between national income and steel ingot production, Fig. 2, would indicate that the industry better stir its stumps and rapidly build new facilities, if credence is given the postwar dollar projections of reputable spokesmen, *on the basis of no depreciation.* Contrariwise, if depreciation is to be the escape hatch, it is also the ultimate failure point for all the postwar projections. Furthermore, a study of past peak load accumulations for steel (Table I, on page 52) has ingrained a certain degree of caution among steel producers.

Further, depreciation pre-supposes that American business anticipates selling relatively high-priced products in a generally deflated world. This in turn conjures the question as to how business proposes to trade competitively and reciprocally in all the global market places so glowingly publicized by various manifestos, and so closely integrated in most plans for exceeding prewar employment figures.

To set all these figures in a proper comparative framework, the President's plan for 60,000,000 jobs can be compared to an all-time peak of 56,000,000 men and women employed in July, 1944. Income projections can be set against the following past performances:

	National Income, Billions of Dollars	National Production (Value of Product)
1st half 1941	44.3	55.3
2nd half 1941	52.6	64.3
1st half 1942	55.3	69.3
2nd half 1942	66.2	82.8
1st half 1943	70.8	89.7
2nd half 1943	77.1	96.8
1st half 1944	77.5	97.1
2nd half 1944	81.5	99.9

Other paradoxes involved in the war bond-consumer buying-national income triangle is that the war bonds are merely legal claims against future wealth and income. And while it is all very comfortable to easily jump this hurdle by mumbling "refinancing," it in no way alters A's giving up money in taxes to pay B's bonds or interest. This sets the stage for much future political wrangling as to who pays what percentage of how much tax. The postwar budgets will cut into middle-class budgets for some $200 to $300 yearly in taxes (See Fig. 2), against $0 to $50 in the prewar period. This will be a new peacetime fiscal experience for Americans and perhaps portends less participation in consumer goods markets and a more acute interest in future governmental policies.

A very burdensome super-structure of debt has historically been a beckoning highway to inflation and thus a systematic expropriation of the middle-class. In terror they then encourage the slow but steady perversion of democratic and humane institutions which leads ultimately to a form of managed economy under the aegis of one or a succession of political opportunists. This trend, which American industry claims to be so frightened of, could have been minimized by industry's forceful support of very high tax structures during the war, straight across the board, which would have served the dual purpose of absorbing the so-called inflationary gap and holding the debt to digestible levels. Marked apathy for such self-discipline mirrored the whole country's soft attitude toward the war and this particular opportunity for basic correction is beyond recapture.

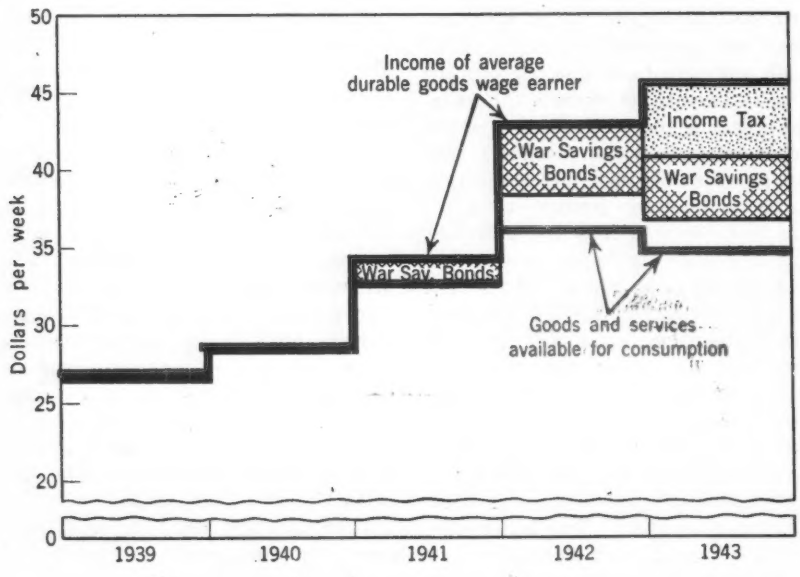

FIG. 1—Averages smooth out many a publicized wage peak. The bulk of war workers, with dependents, war bond purchases, and income tax has not rolled in quite the wealth feature writers so critically portray. Even so, the available goods and services in 1943 were in such short supply as compared with spendable income as to create the dangerous so-called inflationary gap shown here.

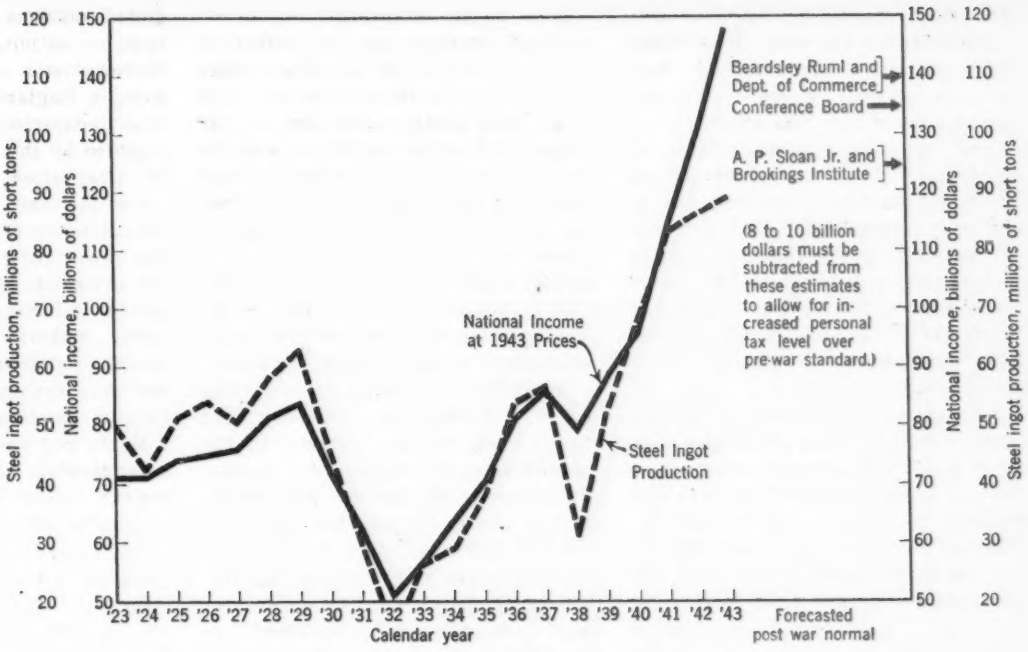
Steel ingot production, millions of short tons
National income, billions of dollars
Beardsley Ruml and Dept. of Commerce
Conference Board
A. P. Sloan Jr. and Brookings Institute
(8 to 10 billion dollars must be subtracted from these estimates to allow for increased personal tax level over pre-war standard.)
National Income at 1943 Prices
Steel Ingot Production
'23 '24 '25 '26 '27 '28 '29 '30 '31 '32 '33 '34 '35 '36 '37 '38 '39 '40 '41 '42 '43
Calendar year
Forecasted post war normal

FIG. 2 — Prewar enthusiasts for heavy construction of steel capacity based their estimates on the remarkable correlation between national income and ingot production. If postwar estimates of income are creditable, new capacity is imperative. Or, perhaps at that time more dollars will buy less steel!

Raw materials, labor and technology will each have their crucial role to play in the future industrial economy, and the trends established a year ago by these factors are even more pronounced today.

For raw materials the stage is being set for an industrial economy forced to operate on more slender underground reserves of leaner analyses. It is a fixed custom to credit solely to the American system of free enterprise the high standard of living in this country, but it is no discredit to this driving motive to appreciate that nowhere else in the world has there been found such ready juxtaposition of rich iron ore and coking coal, or such wide distribution of bountiful reserves of copper, zinc, high grade bauxite, and the many other metallic elements that are so invigorating to a technological society. This is the last war that will be fought with the rich red Lake Superior hematites, and the irresistible drift to beneficiation in that region over the next 20 years has as its corollary higher unit costs. High grade copper resources are petering out and high grade bauxite is about finished. Only in coal is the outlook gratifying.

This dilution of basic wealth does not mean that such materials must necessarily be imported, but the technical improvising so characteristic elsewhere in the world must soon become a part of this country's industrial framework. Technology is clever indeed in wheedling materials from thin and reluctant ores, but the penalty paid is always higher as translated into man-hour costs.

All this is naturally encouraging an appreciation of the philosophy of importation of foreign metals in trade to some way complement dwindling home reserves or at least retard the teriffic rate of attrition. There certainly is considerable merit in the suggestion that such accumulation of raw materials (as also the disposal of war surpluses of machinery and goods) offers a means of cashing in on some of the country's lend-lease credits, or can serve as one means of siphoning purchasing power to the remainder of the world in support of a coveted export trade of U. S. finished products. The building of stockpiles resulting from this policy (Mr. Wallace's ever normal granary carried out in metal) as a means of strategic safeguarding would naturally be carried out under the aegis of government agencies and therefore leads into certain cartel and international political protocols characteristically buttressed by price stabilizations and production controls. This inevitably formalizes a pattern that is apparently so frightening to American business groups, which see further evolution of the cartel system in this country as leading inexorably to greater governmental power with resultant additional regimentation of the nation's business and industry. Just how these irreconcilables will be reconciled, and just what form and degree of purpose of direction will finally develop only the future will disclose.

As regards labor there is no contradicting a fairly general and sizable continuation of mark-up in basic pay rates. This is just another one of the many straws pointing in the direction of a high cost economy with a secondary implication of dollar depreciation. Workers are basing their demands on equity to rises in living costs (partially true), plus equity to increased profits on the part of management (also partially true), plus the desire to sustain postwar national economy and service the public debt (which is inverse reasoning), plus increase in man-hour productivity (questionable, irrespective of the implication in a mid-year production statement issued by H. Ford).

There is little real evidence to support the contention that worker productivity during the war has increased at nearly the rate glorified in publicity handouts. Those slight increases in certain instances are pretty well offset by easy and corrupt practices in other directions, and by careless inefficiencies traceable to labor and to smugly serene management. It is in individual productivity that is found the key to what the future holds. Everything will depend on the rapidity with which the volume of real wealth is produced by the average American in the average hour. If this can be greatly increased—and certainly a great deal remains to be done—it is possible that future high wage and raw material cost structures can be partially offset.

During the war management has succeeded in breaking down exceedingly complicated jobs into small and simple units which can be handled relatively efficiently by hastily trained and sub-standard workers. Irrespective of possible long range psychological reactions to such instances of over-simplification of work, it would seem inevitable that postwar industry will cling to this technique even when the more efficient labor pool is back from the battlefields. Such over-simplification of work may well result in

even more touchy management-labor relationships, what with its complete mechanization of workers who have no pride of skill or sense of visible contribution to the final effort.

Nor has war prosperity been so widely and evenly distributed among potential postwar consumers as is generally publicized. Or, at least averages lead to this conclusion. Some spot sampling of workers has shown the individual war bond holdings in the neighborhood of $250, which hardly is the basis for liberating a suppressed buying spree.

Average weekly earnings in the machinery industry was $51.95 per man in July of 1944; engine and turbine workers averaged $58.84; machine tool workers took home $56.90 weekly; shipyard workers averaged $62.90; iron and steel workers $50; and the automobile industry paid $57.02 (in January 1939 it was $31.55). For all manufacturing industries the average weekly take in 1944 was $50 (against $27.04 in 1935). When these pay checks are adjusted against past dollar devaluation and when tax loads are subtracted, the current prosperity as translatable into future buying is encumbered by certain ambiguities and qualifications.

Of critical influence on postwar buying psychology will be the smoothness of absorption of displaced war workers and returning veterans. Apparently it's going to be a mad scramble of understandable self-interest. The depressing fear of even short-lived unemployment during reconversion will certainly influence many potential customers to hoard what purchasing power they have accumulated.

It is in the integration of the returning veterans into the industrial machine that will set an uneasy stage for sensitive postwar decisions. Both unions and management have so far frequently been over-solicitous with the first freshet of veterans with resultant moral damage to the individual. When the freshet is in full flood, however, unions and management may become equally guilty in exploiting the belligerency, uncertainty, and fear of returning veterans to secure short-lived advantages in the struggle for power.

Sensitivity to all these variables has led to a widespread conclusion that Government will be involved in the maintenance of employment, particularly during the complex and erratic shadow phase. To industry this looks like the 1930's all over again. Confident of a postwar boom to tax productive capacity, industry spokesmen have gone all-out in assuming responsibility for full employment in exchange for freedom of action for private enterprise.

Here again the demands for freedom are hedged by certain ambiguities. Industry's contention is well taken that the heavy tax load on risk undertakings be eased, and this is likely to occur. But, the certainty of heavy postwar tax loads precludes attainment of full freedom of action.

And, while there is no evident pressure for Government to do away with tariff protection, industry spokesmen have taken a surprisingly firm stand against international cartel arrangements which has led to a somewhat more hesitant stand against domestic monopolies. American business feels sufficiently virile to go it alone in the global markets without the restrictions on output, territory or price so characteristic of cartels. Contrariwise, in England and Germany it has been industrialists who first became beguiled by the debilitating stabilities of cartelization.

On the one hand, therefore, certain divisions of the U. S. Government are prosecuting American businesses for numerous prewar cartel commitments, whereas other government policy-makers are preaching the merits of postwar cartels under Federal sponsorship. The same split personality exists regarding monopolies, with the government prosecuting such arrangements while encouraging their growth, and with business groups also distributed on both sides of the fence.

As regards metals technology in 1944, little happened of real significance, and it seems unlikely that 1945 will witness anything of basic influence. In the steel industry there is a great deal of attention paid to the likelihood of electric furnace overcapacity resulting in the softening of prices in electric furnace steels to the level of open-hearth competitive products. Larger electric furnace units, using decarburized or blown hot metal has brought unit productive capacity within the general competitive area of open hearths. Counterbalancing this is the war-demonstrated ability of the basic open hearth to meet electric furnace quality standards, by means of basket pouring with related higher working and pouring temperatures, refined pit and mold practice, and process control ranging on through the soaking pit.

Just as soon as war demands ease

PREWAR PRODUCT PEAKS AND ESTIMATED STEEL CONSUMPTION

PRODUCT	Peak Year	Production Units	Steel Purchased per Unit Produced	Estimated Total Steel Consumption for Peak Year, Net Tons	Estimated Product Requirements, Net Tons				
					Shapes and Piling	Bars (Including Reinforcing)	Plates	Light Flat-Rolled	All Other
Passenger automobiles	1929	4,587,400	1.7	7,800,000	40,000	2,308,000	201,000	6,552,000	932,000
Trucks	1937	893,085	2.5	2,233,000					
Freight cars	1923	178,166	17.5	3,118,000					
Passenger cars	1926	2,900	46	133,000	834,000	694,000	1,359,000	376,000	868,000
Locomotives	1923	4,400	200	880,000					
Rails	1926	.....	....	3,604,000	.....	.....	.....	.....	3,604,000
Rail fastenings	1926	.....	....	1,470,000	.....	402,000	.....	.....	1,068,000
R. R. frogs and switches	1929	.....	....	162,000	.....	.....	.....	.....	162,000
Mechanical refrigerators	1941	3,900,000	225	439,000	.....	19,000	.....	390,000	30,000
Washing machines	1941	1,892,435 electric and 122,000 gas	130	131,000	.....	6,000	.....	116,000	9,000
Kitchen ranges	1941	2,300,000 gas and 728,000 electric	200	303,000	.....	14,000	.....	270,000	19,000
Farm machinery, equipment	1941	.....	....	1,553,000	93,000	777,000	67,000	385,800	231,000
Ship and ship repairs	1939	.....	....	489,000	75,000	34,000	296,000	20,000	64,000
Steel barrels	1940	16,350,000	40	327,000					
Other containers	1941	.....	....	3,185,000	.....	11,000	109,000	3,319,000	73,000
Machines and tools	1939	.....	....	1,000,000	76,000	216,000	176,000	341,000	191,000
Oil, gas and mining	1940	.....	....	1,786,000	68,000	88,000	345,000	129,000	1,156,000
Total construction	1929	Includes residential construction. In 1926, peak year, 729,000 single and two-family homes built, taking estimated 1,575,000 tons of steel including heating systems.	....	8,643,000	2,939,000	1,815,000	1,383,000	1,469,000	1,037,000
Total	....	.....	.....	37,256,000	4,125,000	6,384,000	3,936,000	13,367,000	9,444,000

Data: A. I. S. I., THE IRON AGE, and other sources.

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FIG. 3 — Durable goods purchases represent about 15 per cent of family expenditures once income is raised to $3000, or thereabouts. If family income distribution follows the neat pattern laid down by prognosticators, durable goods industries will enjoy greater participation in postwar markets.

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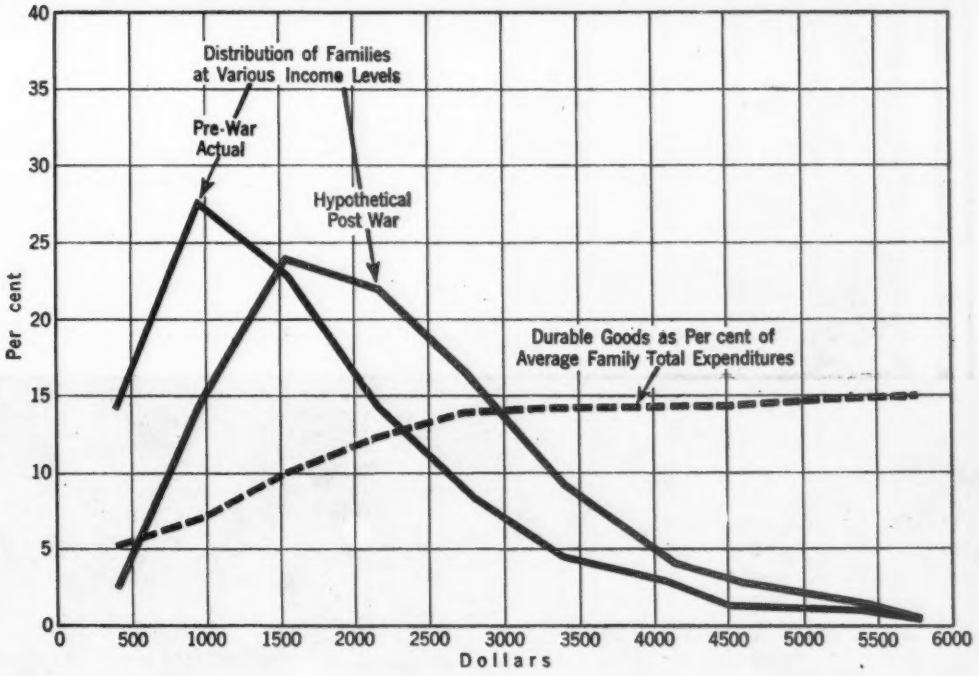


it is quite possible that an electric furnace-open hearth battle of attrition will develop, but the surprising thing is that all observers who solve the problem of excess electric furnace capacity in this manner fail to recognize that the competitive knife has two cutting edges. When the pressure for outlets reaches the point that electric furnace producers seek production by means of price cutting there is nothing to prevent the open hearth interests from dropping their prices to maintain an advantageous price gap. The economics of the two operations are such that in an all-out struggle for dominance the open-hearth can likely far better stand the price pace. However, since many steel mills have both types of capacity and since this situation would quickly be obviously debilitating, it is unlikely that the future role of electric furnace steels will be nearly as belligerent as observers prophesy.

A fair amount of proprietary research is being expended on low-alloy high-tensile steels, and the resurgence of interest has undoubtedly been accelerated by the potential peace-time competitive threat of high-tensile, high-yield, wrought aluminum alloys with hot precipitation hardening characteristics of the Alcoa (type 75S) and Reynolds (type R301) analyses. These or even better aluminum alloys will threaten a worthwhile volume of steel tonnage. The steel developments have progressed to such a point that they offset to some degree the potential inroads of aluminum and magnesium alloys.

In the field of highly alloyed steels for high temperature service a tremendous amount of current research is being concentrated. Such developments have definite postwar objectives. Rocket ordnance, jet aircraft and gas turbines, and the like have surged from a theoretical to a practical basis during the war, with consequent demands for alloy steels to operate in temperature ranges above 1700 deg. F. Any research leading to the development of steels with temperature life even a few degrees higher than currently standard is well worth the effort expended. There is expectation that jet and gas turbine equipment will find wide application in postwar aircraft, and gas turbine applications in railroad and marine equipment are now considered certain.

In the general steel picture the "equivalency" of many of the war emergency steels will lead to a continued trend in buying on the basis of actual physical properties. The trend of hardenability as the main requirement of steel will be transferred bodily into postwar buying and production. The physical properties of fully tempered martensite in steel of a given carbon content are quite similar regardless of the alloys used, except in the field of high alloy steels. Since hardenability is what many consumers of steel are after, the postwar period will likely see wider limits to the specific chemistry of certain steels. Since molybdenum is particularly efficient in contributing greatly to hardenability and does readily oxidize out of steel, the increasing participation of molybdenum-containing steels established prior to the war will likely be maintained in the postwar period.

The so-called needled steels with boron as a constituent will undoubtedly have a role to play, but since boron is a very fugitive element and since boron additions are not nearly so inexpensive as has been indicated the function of this war-developed alloy in the postwar period will be definite but comparatively minor. Boron technology has, however, titilated the imagination of steel metallurgists as to potency of minute quantities of alloying elements, a sphere of interest already plumbed by their nonferrous compatriots.

Any broadening of the chemistry bands on steels during the postwar period could well facilitate the absorption of the large volumes of alloy scrap that are building up here and will flood in for years from dismantled war equipment, but here again the utilization of such alloy scrap is tied in with competition pressures in the postwar period. If the search for business gets to be intense there will certainly be a disinclination to employ large quantities of alloy scrap over which there is not the fullest control of residual elements. The catholic nature of alloy scrap precludes close control of hardenability in the refining stage and could well result in many off-heats for which a home would have to be found or divergencies from specifications which would not be satisfactory to particular consumers.

The steel industry therefore may well ignore the large quantities of available alloy scrap and prefer the utilization of clean charges with specific inoculations of known quantities of the various ferroalloys.

Flame scarfing armor plate for one of the Navy's super-battleships. Shipbuilding in 1944 was again the largest consumer of steel, accounting for about one-fifth of all finished steel.

Steel, 1944

After working itself into a comfortable mid-year position, the steel industry is again entering a period of schedule improvising, maintenance difficulties, delayed deliveries, sudden shifts in military requirements, and an impending series of labor demands.

By Tom Campbell

AFTER having had a small glimpse of what it is like to have a normal flow of steel orders with a satisfactory product mix, the steel industry as the year closed was abruptly faced with a secondary war steel demand peak. This had all the ear marks of bringing back schedule difficulties, deferment of some CMP orders and a general push-back on essential and regular civilian requirements.

As the year ended and as the steel industry produced more steel than is apt to be equalled for some time (89,500,000 net tons), the tempo was one of war steel first and everything else second. There was little indication that "seconds" would get much attention. Shell steel, Navy structural requirements and general war items were in greater demand than at any time since 1943.

As an actual illustration, the change in the battlefronts in Europe resulted in an increase of ammunition steel from about 300,000 tons a month in November 1944, to an extended program of 560,000 tons a month in March 1945. Should the Germans not be definitely put out of the war by that time, indications were that munition steel needs would rise to even higher levels.

The impact of shell steel needs, which when related to total output are small, nevertheless, has an effect upon the production of such products as semi-finished steel, rails and hot rolled bars. Most of these items are made on the same type of mills which produce the semi-finished form or the final shape of requirements for shell steel. Demands from the railroads were so great for rails that every effort was being made to see that the nation's carriers were supplied with the tonnage of rails desired—especially in view of the substantial cutback in 1944 requirements.

With the start of the new year and depending entirely upon the course of the European War, there was little chance that civilian requirements, no matter whether they were essential or non-essential, would be fulfilled in any greater amount than they were in the past several months. Even though manufacturers had substantial and logical plans for their postwar activity, the failure of the most optimistic views for an early ending of the European War to materialize had satisfactorily shelved excessive conversation and action on postwar requirements. Until Germany is definitely crushed, civilian users of steel were reconciled to the advancement of war requirements even in lieu of essential civilian production.

Early in 1944 the steel industry had comparatively easy sailing. War contracts were heavy; products were profitable in many cases, and generally there was no question of "going out and getting the business." Net sales returns, despite huge sales of hot rolled sheets, plates and structural steels were enhanced by special war items. However, by the middle of the year many of the latter passed out of the picture. This situation had a profound effect upon the so-called product mix, and hence the profit picture in the steel industry.

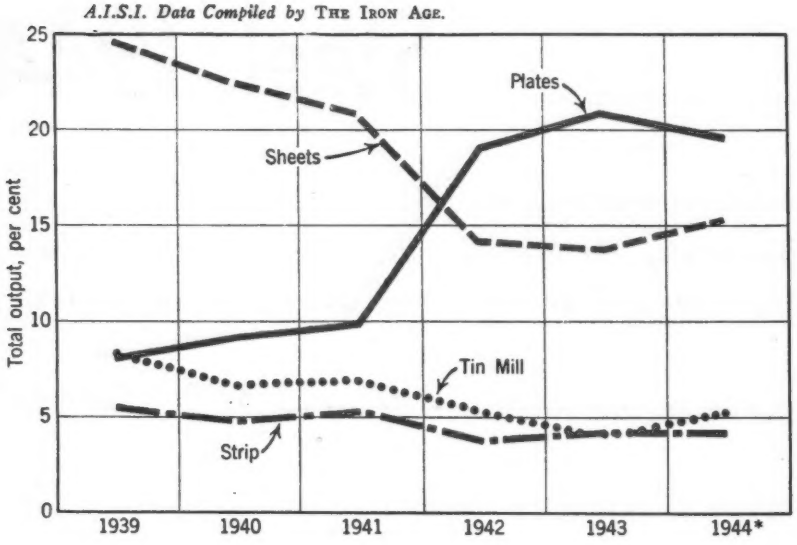
Most steel companies by the middle of 1944 had begun to indicate a substantial decline in net income due entirely to the change in the type of products being produced for the war effort. Regardless of this fact there was little squawk from the industry on the subject of prices. As a matter of fact the steel industry, through its OPA Advisory Committee in March of 1944, was so cognizant of the wage problem and the anti-inflation stand of the administration that it withdrew its demand for higher steel prices on certain products even though the OPA had expressed willingness to make agreed-upon adjustments.

However, with the recent WLB wage award and with the adverse change in the production of profitable items, it became apparent as the year ended that the steel industry would be forced to ask for price relief which it did. Its base prices had been unchanged for several years. Despite the fact that the industry had gained certain advantages, such as the charging of some extras, which in normal times were "conveniently forgotten," and despite the fact that the industry was allowed to charge freight to so-called dislocated areas (locations which during normal times were not generally serviced by a steel company), it was apparent according to reliable information that many steel companies were, from a financial standpoint reaching the "end of their rope." Although considerable conversation along this line made its way into public print in 1944, there were many reliable indications that now the "wolf was at the door."

With large steel companies feeling the effect of net financial reverses, small non-intergrated mills as the year opened were facing even more urgent problems. Many of these small companies had fallen into the reluctant habit of looking for relief from quarters other than themselves. Some of the more enterprising companies, however, had and were still realizing that their salvation depended upon the aggressiveness with which they studied steel markets and the ardor with which they attacked this problem. The author is conversant with some small companies which are sin-

Flatrolled Product Shipments in Per Cent of Total Steel Shipments 1939-1944

A.I.S.I. Data Compiled by THE IRON AGE.



cerely independent of large steel company trends.

Those small steel companies which do not want an umbrella put over them have already planned their action for the postwar period. These concerns are completely uninterested and cold to any plans which are promulgated "to help the little fellows." They have already sounded out their markets and they know precisely to whom they will sell steel in the postwar period and, furthermore, they do not extend themselves into consumption lines which are unprofitable. In other words they have looked the field over, they know where they fit in and they are going after that type of business.

The question of the small steel company, especially in view of predicting or discussing 1945 potentialities, brings to mind the cloak room talk small companies which derive their raw materials from larger steel companies and then compete with the latter with the same finished products may be forced out in the postwar period. This has been a general refrain for many years and the same tune will probably continue for many years to come. The mortality of non-integrated mills in the past few years is such as to confidently predict that those which now exist will weather any storm either productwise or pricewise in 1945 and in the postwar era.

Fortunately for some small companies the active heads have been smart enough to cash in on normal or perhaps sub-normal mistakes in judgment made by the larger companies. For instance, some smaller steel companies knowing that the larger ones are primarily interested in tonnage have gone out after specialized or "hand made" steel orders. Thus these small companies have been able to select their business, keeping in mind the type of product as well as the necessary freight absorption.

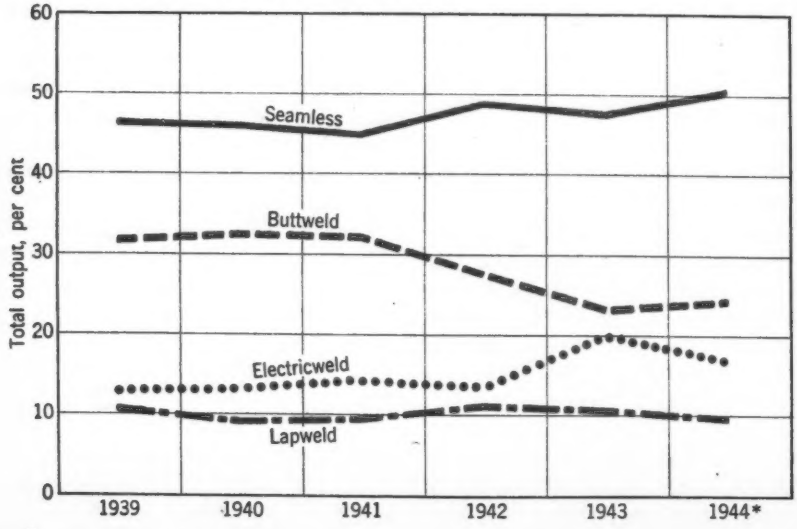
Similar to the larger companies the smaller units are by no means uniform in their opinion as to their salvation. Some want to bask in the limelight of general steel demand supported by the crumbs which fall from the table of the larger companies, while others have adopted the David and Goliath attitude. On the basis of past experience, those companies in the latter category will be recorded in the American Iron & Steel directory for many years to come, for the simple reason that they represent the backbone of American endeavor—free enterprise, regardless.

While the small companies are struggling with their problems, even the larger ones are having their headaches. Early in 1944, lucrative government contracts were such that little or no worry was expended on the balance sheet. Shell steel, armor plate and other special war items were sufficient to carry the burden for such steel products as semi-finished steel, plates, hot rolled sheets and rails. During the middle of 1944, however, the more profitable war items were cut back with the result that the net realized price for steel products dropped substantially. It was this factor, probably more than any other, which caused steel companies to become strongly active recently in seeking price relief from the Office of Price Administration.

Common to both large and small steel companies, also, has been the substantial increase in the average wage rates paid. This is somewhat different from the so-called basic wage rate. The so-called basic rate for common labor is 78c. an hr. However, because of the longer work-week and because of overtime, steel companies were paying an average hourly rate of $1.18 per hr. This is in sharp contrast to an average of around 68c. an hr. in 1936, and 84c. an hr. in 1938, the latter incidentally represented the year taken as a freezing point for steel prices. Most steel executives realize that their biggest customer in the past few years has been the government, but they are also haunted by the fact that when the war is over,

Pipe and Tubing Output by Process, in Per Cent of Total Production 1939-1944

A.I.S.I. Data Compiled by THE IRON AGE.



they will have high basic wage rates and a highly competitive steel sales market.

Realistic steel people freely admit that they are between their customers and the strong steel union. The customers want the lowest price possible, while the steel union wants the highest wage possible. Even the foremost of industrial relations managers know that the union is here to stay, while even the lesser lights, in the sales organizations know that the steel customers will exert their pressure pricewise. The sum total of this is to place the industry, for some time to come, squarely behind the eight ball. There is no particular reason to believe that steel executives cannot satisfy both the customer and the employees and still support the contention that steel production is the country's No. 1 endeavor.

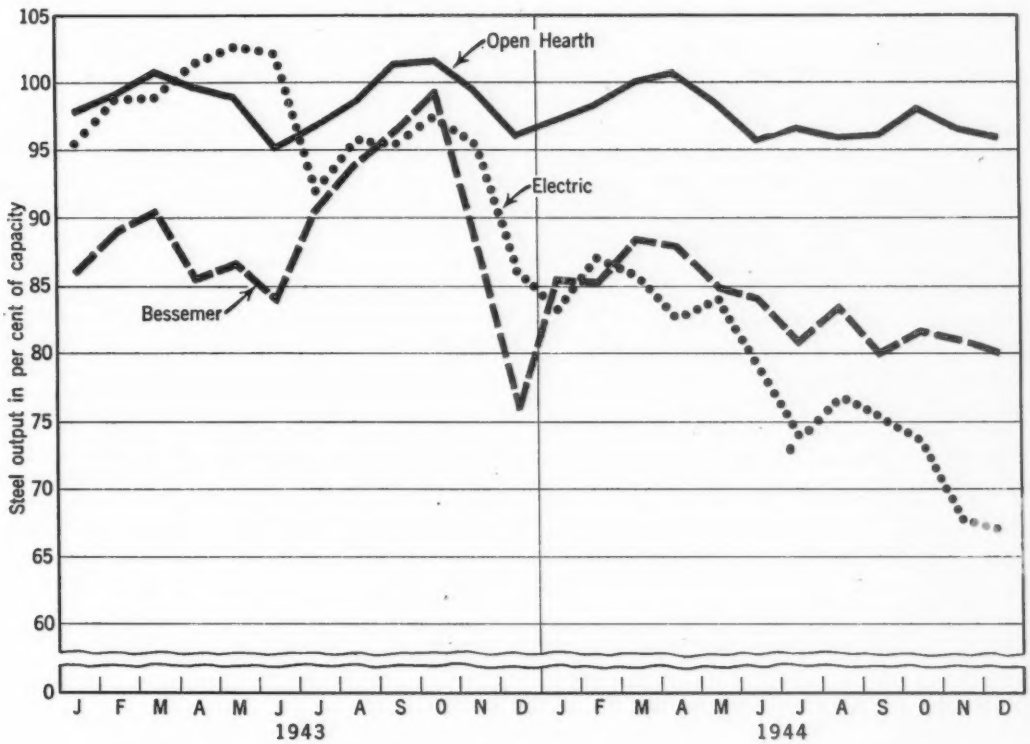
Unsung and generally unrecognized are the steel production men who, after all, must make good the promises of the steel industry to their customers, regardless of price or wage costs. These men have done a superb job in 1944, just as they had done in 1942 and 1943. Despite the need for furnace repairs and the lack of manpower, steel production for 1944 was approximately 89,500,000 net tons. On top of this achievement there were very few cases in the past year when steel for the Armed Forces was not forthcoming when required by the military. The sweat, toil and accumulation of practical experience which made this achievement possible can probably never be told in words or figures. It is something which practical steel men will use as a bogey to shoot at in future years.

Estimated finished steel production for 1944 was about 63,846,000 tons. The distribution by consuming industries changed but little from 1943. The general pattern of distribution as shown in Table II should be interpreted by the knowledge that war production is included in practically every consuming industry. Especially is this true in the miscellaneous category where for security reasons many ordnance and other war products have been included. It is obvious that a more complete analysis, were it possible, would show a general pattern for 1944 somewhat similar, on a percentage basis to 1939, the only difference being the substantial increase in the actual tonnage of steel produced.

Shipbuilding in 1944 continued to take the largest portion of steel shipments exclusive of miscellaneous tonnage, just as it did in 1943. Estimates show that in 1944 shipbuilding alone consumed close to 19 per cent of total steel shipments compared to 21 per cent in 1943. This relatively insignificant decline was due largely to the dissipation of Maritime inventories during the latter half of 1943. In other words the amount of steel that went into shipbuilding in 1944 and 1943 was substantially the same for each year.

The increase in the amount of steel going into agriculture in 1944 was primarily due to a belated recognition that without farm implements, the nation's food supply would suffer. Probably more than any other essential civilian endeavor, steel for agricultural needs was, by the middle of 1944, adequately supplied. Only a manpower shortage in the closing months of the year prevented the farm implement industry from stepping up production to desired levels.

The consumption figure for the automotive and aircraft industries was more or less affected by the inclusion of war items and as such is of little value for use as a postwar estimate. It is estimated that these two groups consumed in 1944 a total of close to 5 million tons of steel or 7.4 per cent of total steel shipments. This is a far cry from 1939 when the automotive industry consumed 15 per cent of total steel shipments. There is no reason to believe that when the war



OPERATING RATES: Steel output by methods in per cent of capacity for the years 1943 to 1944; A.I.S.I. data compiled by THE IRON AGE.

TABLE I

Production of Iron and Steel, by Product (1929, 1935-1944)

(In Net Tons and Per Cent of Total)

Year	Plates (Universal and Sheared) Tons	% of Total	Sheets and Strip Tons	% of Total	Shapes Tons	% of Total	Bars (Hot Rolled, Cold Finished, Tool Steel, Carbon and Alloy) Tons	% of Total	Pipe and Tubes, Skelp and Billets Tons	% of Total	Wire and Wire Products, Wire Rods Tons	% of Total	Tin, Terne and Black Plate Tons	% of Total	Rails, Wheels, Axles, Ties, Splice Plates Tons	% of Total	All Other Tons	Total Production Net Tons
1929	5,624,798	12.2	8,688,726	18.8	5,351,382	11.6	8,314,316	18.1	5,487,339	11.9	3,510,538	7.6	2,418,274	5.2	4,389,938	9.5	2,212,435	45,997,746
1935	1,629,987	6.1	8,761,924	32.8	1,959,709	7.3	4,767,187	17.8	2,582,104	9.6	2,733,689	10.2	2,307,462	8.6	1,193,199	4.4	905,037	26,840,298
1936	2,829,950	7.5	11,447,319	30.2	3,245,346	8.6	6,822,492	18.0	4,225,272	11.2	3,357,626	8.9	2,945,232	7.8	2,053,851	5.4	930,456	37,857,544
1937	3,632,438	8.8	12,023,275	29.2	3,670,068	8.9	6,755,012	16.4	4,705,954	11.4	3,370,405	8.2	3,308,576	8.0	2,320,896	5.6	1,391,732	41,178,356
1938	1,919,835	8.1	6,948,749	29.5	2,082,685	8.8	3,484,923	14.8	2,882,471	12.2	2,361,630	10.0	2,191,905	9.3	993,684	4.2	703,069	23,568,591
1939	3,101,981	7.9	11,858,772	30.4	3,358,985	8.6	6,138,350	15.7	4,348,630	11.1	3,680,297	9.4	3,468,358	8.9	1,994,796	5.1	1,117,384	39,067,553
1940	4,323,408	8.9	13,783,700	28.4	4,232,346	8.7	7,885,261	16.4	5,029,966	10.5	4,351,848	9.1	3,625,551	7.5	2,399,494	5.0	3,028,795	48,660,369
1941	6,199,575	9.9	16,142,759	25.9	5,724,836	9.2	10,978,698	17.6	6,583,495	10.6	5,268,423	8.5	4,818,922	7.7	2,961,999	4.8	3,648,080	62,324,187
1942	11,799,600	18.8	11,248,392	18.1	5,969,009	9.6	11,939,982	19.2	5,939,915	9.5	4,632,017	7.4	3,520,059	5.7	3,090,294	5.0	4,306,848	62,445,914
1943	12,900,000	20.2	10,899,000	17.0	3,758,000	5.8	12,005,000	18.7	5,861,000	9.1	4,385,000	6.8	2,324,000	3.6	3,184,000	5.0	8,088,000	63,400,000
1944	12,457,356	19.5	12,256,903	19.2	3,977,790	6.2	11,108,920	17.4	6,293,709	9.9	4,521,991	7.1	3,262,044	5.1	3,985,464	6.2	5,979,947	63,846,124

NOTE: Data for 1929, 1935-1943 from A.I.S.I.; 1944 figures are estimated by the author.

is over, the automotive industry will not return to its prominent position among the heaviest consumers of steel products. This is especially true because of the 6 million car year goal when, as and if material and manpower are available.

In passing it is interesting to note that a consensus of automotive officials in Detroit indicates that practically no cars will be off the assembly lines for at least four months after V-E Day. At the end of eight months, it is estimated that the industry will be turning out cars at the rate of 3 million a year and will not reach the 6-million-car-a-year rate until 12 months after Germany is defeated. Graphically this would mean a zero number of cars in the first four months after V-E Day, an average rate of 25 per cent of the bogey in the second four months, and an average rate of 75 per cent of the bogey in the last four months, or an average of 33 1/3 per cent of the 6 million-car-a-year goal for the first year after Germany is crushed.

Steel makers, despite their current preoccupation with the production of war steel, have their eyes on Detroit. This is understandable when it is realized that the total sheet output in 1944 was not changed much from 1939 output despite the fact that total steel production expanded substantially. Even more striking is the fact that in 1939 sheet output represented more than 24 per cent of total steel shipments, as compared with 15 per cent in 1944. It is expected that in the second and third postwar years sheet production will climb to its past prominence.

The sheet picture when minutely examined discloses one of the major reasons why the steel industry has become cost conscious. In 1939 as in 1944 the relationship between hot rolled sheets and cold rolled sheets was changed but little. However, total production of cold rolled sheets in 1944 was almost identical to prewar years despite the overall increase in finished steel output. Since a relatively good return is obtained by way of extras on cold rolled items, it is obvious that the profit column suffered by this static characteristic in cold rolled sheet and strip output.

Due to deterioration of rolling stock as well as increased demand for hauling, the nation's railroads enhanced their steel consuming position in 1944. Last year they consumed about 9.6 per cent of total steel shipments, compared to 8.1 per cent in 1943 and 8.3 per cent in 1939. When war requirements no longer collide with rail and freight car needs it is expected that the railroads will consume a larger percentage of yearly steel output. Despite the grandiose plans of many railroads, it is believed that the carriers, when faced with reduced revenues, will pull in their horns as far as new construction is concerned. This does not mean, however, that the railroads will not be a prime steel consumer in the postwar period. Some authorities have placed their demand at around 5 million tons a year for several years. Whether or not this materializes will depend entirely on the railroad's ability to compete with trucks, planes and private cars in the postwar era.

From a steel product standpoint, steel plates in 1944 continued to lead the parade and represented almost 20 per cent of total steel production, similar to the 1943 experience. As long as the war continues and as long as the Maritime Commission is able to implement its desires, the percentage of plate production to total steel output will remain somewhat above prewar levels. Generally speaking any decline during the next year in plate output will be immediately absorbed by sheet production. Furthermore, the financial return to steel companies on sheet output is more lucrative than is obtained on plate shipments. In 1939 plate production represented about 8 per cent of total shipments. In the postwar period, however, the abnormal increase in construction would suggest a greater participation for at least two or three years.

In 1944 tin mill products consumed about 5.1 per cent of total steel output, compared to 8.1 per cent in the 1939 prewar period. The difference between the two participations can be accounted for by necessary restrictive measures involving general line can products. After the war there are expectations that tin mill output will assume its normal percentage of total shipments. Since this is a lucrative product from a profit standpoint, the comeback cannot come too soon for sales managers.

On an overall steel production basis, it is interesting to note that open hearth steel output was maintained at from 96 to 100 per cent of capacity during 1944, despite the increase in new facilities. Contrasted to this experience the production of bessemer steel declined from a high of 88.5 per cent in March 1944 to about 80 per cent in December. Even more marked from a capacity operations basis was the experience of electric steel, which having reached 102.7 per cent of capacity in March 1943, continually dropped until in December 1944 it was around 67 per cent of rated capacity. The decline in actual production, however, was not as marked as the decline in percentage of operation figures. Nevertheless, the hullabaloo over electric steel capacity in 1942 is

TABLE II

Steel Distribution by Consuming Industries (1937 to 1944)

(In Net Tons and Per Cent of Total)

	1938		1939		1940		1941		1942		1943		1944	
	Tons	Per Cent	Tons	Per Cent	Tons	Per Cent	Tons	Per Cent	Tons	Per Cent	Tons	Per Cent	Tons	Per Cent
Agriculture	1,109,920	4.7	1,420,697	3.6	1,629,849	3.3	1,682,753	2.7	1,166,482	1.9	1,462,127	2.3	1,950,162	3.1
Aircraft	(a)		(a)		51,400	0.2	560,918	0.9						
Automotive	4,053,280	17.2	5,906,358	15.1	7,964,923	16.4	9,847,222	15.8	3,598,494	5.8	3,459,601	5.4	4,761,538	7.4
Construction	4,398,240	18.7	6,100,386	15.6	6,935,889	14.3	10,221,167	16.4	10,714,977	17.3	6,639,509	10.4	6,240,197	9.8
Containers	2,136,960	9.1	2,978,463	7.6	3,067,517	6.3	4,611,990	7.4	4,070,824	6.4	4,301,134	6.8	3,878,161	6.1
Furniture, furnishings	868,000	3.7	1,182,235	3.0	(b)		(b)		(b)		(b)		(b)	
Machinery, tools	831,040	3.5	1,460,000	3.7	2,330,365	4.8	3,365,506	5.4	2,852,077	4.6	3,275,323	5.2	3,270,156	5.1
Oil, gas, water, mining	1,820,000	7.7	1,841,599	4.7	1,900,286	3.9	2,929,237	4.7	1,585,969	2.5	1,903,285	3.0	2,484,068	3.9
Pressing, form., stamp.	(c)		659,864	1.7	2,296,355	4.7	3,677,127	5.9	2,782,752	4.4	2,838,530	4.5	1,934,547	3.0
Railroads	1,443,680	6.1	3,250,022	8.3	4,019,219	8.3	5,983,122	9.6	4,400,444	7.1	5,172,196	8.1	6,134,249	9.6
Shipbuilding	389,760	1.7	517,771	1.3	999,858	2.1	2,929,237	4.7	10,389,766	16.6	13,318,107	21.0	12,011,301	18.8
Exports	2,422,261	10.2	2,817,482	7.2	8,719,805	17.9	6,045,446	9.7	10,800,000	17.3	8,850,116	14.0	5,107,690	8.0
All other	4,095,810	17.4	10,932,676	28.2	8,744,903	17.8	10,470,462	16.8	10,104,129	16.1	12,180,072	19.3	16,094,055	25.2
Total	23,568,951	100%	39,067,553	100%	48,660,369	100%	62,324,187	100%	62,445,914	100%	63,400,000	100%	63,846,124	100%

NOTE: Distribution 1937 to 1938 by M. W. Worthing, based on data from The Iron Age; 1939 to 1943 from The Iron Age, various Government reports, and A.I.S.I. estimates, with jobber tonnage distributed and other alterations made by the author according to the technique devised by M. W. Worthing; 1944 data are estimates by the author.

(a) Negligible, or not available and included in All Other.
(b) Included in Pressing, Forming, Stamping.
(c) Included partly under Furniture and Furnishings and partly under All Other.

a question and a subject which many people would like to forget.

In 1939 total alloy steel output was but 6 per cent of total steel production. In 1943, however, alloy steel output had climbed to about 15 per cent of total steel production. The falling off in orders for alloy steel in 1944 reflected a 12 per cent participation for that year. Comparative figures showing total output in thousands of net tons for alloy steel and carbon steel are as follows:

(Thousands of Net Tons)

	Alloy	Per Cent of Total	Carbon	Per Cent of Total	Total
1939	3,212	6.1	49,587	93.9	52,799
1940	4,966	7.4	62,017	92.6	66,983
1941	8,206	10.0	74,633	90.0	82,839
1942	11,526	13.4	74,506	86.6	86,032
1943	13,150	14.9	75,235	85.1	88,385
1944	10,559	11.9	77,941	88.1	88,500

Even more important from steelmakers' interests is a breakdown of alloy steel in terms of open hearth and electric. In view of the substantial increase in electric steel capacity, open hearth makers of this type of steel expect rough competition. On the other hand owners of electric furnaces are looking for identical viewpoints from open hearth alloy steel producers. One large electric steel producer has told the writer that regardless of the differential between open hearth and electric steel he will continue to operate his units. During the closing year of 1943, electric steel operators had the support of WPB, which threw alloy steel business to them at the expense of alloy open hearth output. The gravy train, however, did not last long because of the falling off in alloy steel demand and within a few months a "free market" was established whereby the customer could specify the method of production.

Comparative figures on the output of alloy steel, both open hearth and electric, for recent years are as follows:

Alloy Steel Output

(Thousands of Net Tons)

	Open Hearth	Per Cent of Total	Electric	Per Cent of Total	Total
1939	2,459	76.7	749	23.3	3,208
1940	3,675	74.0	1,288	26.0	4,963
1941	5,740	70.1	2,462	30.0	8,202
1942	8,133	70.6	3,393	29.4	11,526
1943	9,217	70.1	3,933	29.9	13,150
1944	6,938	65.7	3,621	34.3	10,559

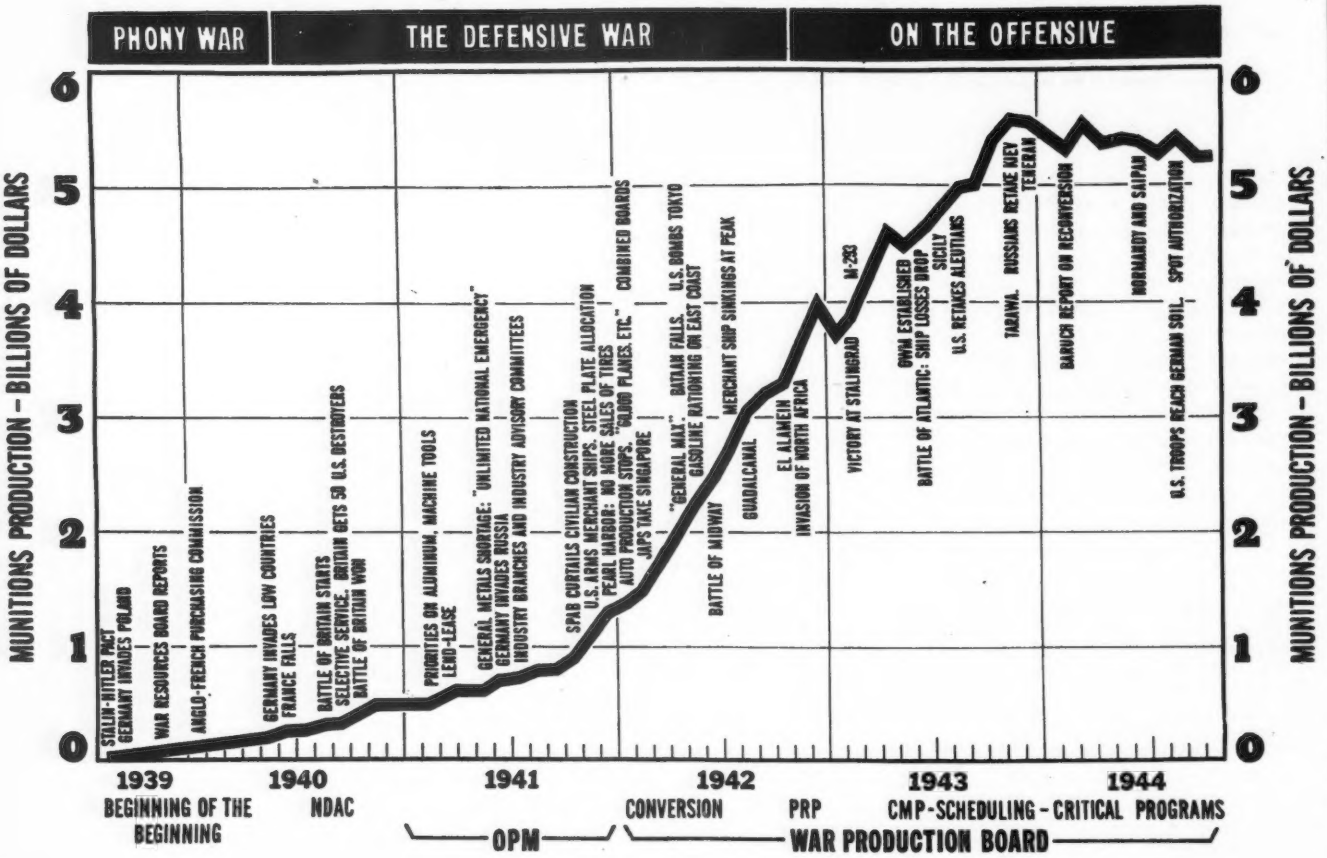
Of particular interest to the steel industry and its consumers has been the recent trend of pipe making. Considerable backroom talk has been current as to the inroads made by electric weld pipe. In 1939 seamless tube and pipe accounted for about 46 per cent of total tubes and pipe output. Electric weld represented about 12.4 per cent. By 1943 electric weld had climbed to 20 per cent of total pipe production, compared to 47 per cent for seamless. However, preliminary figures for 1944 indicate that demand for seamless tubes has supported 50 per cent of total tubes and pipe output compared to about 17 per cent for electric weld.

Lapweld pipe, which according to some observers was written off as an outmoded product some years ago, continued to represent in 1944 about the same proportion of total pipe production as it did in 1939. This may be another indication that small steel companies can continue in business regardless of opinions to the contrary.

Buttweld pipe, which derives considerable support from construction activity, represented about 24 per cent of total tubes and pipe output in 1944, compared with 31.3 per cent in 1939. The drop in construction activity engendered by WPB curtailment was probably the major reason for the low participation in buttweld output. It is to be remembered, however, that actual production of buttweld pipe has increased since 1939. When construction activity picks up it is anticipated that buttweld participation will rebound.

Although considerable emphasis has been placed upon postwar problems, the first few years after V-E Day will find steel demand measured by the ability to produce the required products. While the interval between war production and civilian production will take several months, there is little doubt in the industry that after that period of readjustment, production will climb. The consensus in steel circles is that three months after V-E Day operations may sag to as low as 50 per cent of capacity. Within six months after Germany is defeated, steel output may be between 65 and 70 per cent. At the end of 18 months steel experts believe that the influx of civilian orders plus strong Pacific war needs will support a rate of 90 per cent of steel capacity.

Within one year after Germany is defeated, some analysts predict that civilian production will be about 80 per cent of 1939 output, but the course of the Japanese war will govern this. Other observers, however, believe that such a pattern may be too pessimistic. Those versed in export business see a demand from abroad extending for at least two years after the war which will be paced only by the capacity to produce. Whether or not steel companies will be able to benefit financially from such a demand depends upon their ability to balance prices with demand and at the same time offset high wage costs by more economical production and distribution.



The story of war production, from the beginning of the beginning to spot authorizations. Instead of continuing the "close out" in late 1944 the 1945 curve may well mount to a new peak.

War Production

With 1945 now scheduled as a two-war year the available supplies of many essential war metals again are critical. Extreme pressure on wire mill products is to be expected; and brass strip, rod, and tube requirements exceed available facilities and manpower.

By Hiland G. Batcheller*

FOR the second time during current hostilities, the supply of many essential war metals is critical. Steel, copper, brass and lead head the list as the artillery and small arms ammunition program overshadows all other developments in its impact on the metal industry. New battle developments in the past few weeks have intensified the critical metal situation.

Steel is critically needed at the start of 1945 in finished steel products, however, whereas shortages in 1941 stemmed from the pig iron up. Copper shortages are principally in alloys, brass mill strip and rods. The lead situation has tightened up to a point that the War Production Board recently announced that 1945 requirements were in excess of supply with government stockpiles dwindling rapidly. A sharp cutoff in civilian consumption is in prospect.

Effects of the simultaneous expansion of the small arms and artillery ammunition programs will be far reaching. To meet the 50 per cent increase in brass mill production for this program, steel rolling mill facilities may be used in the production of brass strip. Also Canadian brass mills will be "borrowed." Copper clad steel will be produced in increasing quantities to relieve the strain on the brass mills.

The demand for steel and copper cuts across virtually the entire critical list of combat loaders, ammunition, heavy-duty trucks, tanks, etc., and the resurgent requirements for these products may well lift the $5,300,000,000 average monthly munitions production which has prevailed for more than a year to even higher levels.

* *Chief of Operations, War Production Board.*

Munitions production in 1944, as shown in the "Story of War Production" chart, climbed to the unprecedented total of around 64 billions of dollars, a gain of more than seven billions over 1943. While the overall picture is reasonably satisfactory, the 1944 year-end finds about 40 per cent of schedules lagging, with about 28 per cent of the total program in critical products. The overall 1944 total would have exceeded the 64 billion figure had it not been for cutbacks in plane production.

The transition in 1944 from war planning into direct combat operations has brought the war many months nearer to all producers of war needs. Shortages at the factory now directly affect the embattled soldiers, sailors and marines. This trend calls for more flexibility and use of materials as industry becomes faced with increasing material and manpower shortages.

When the American industrial machine geared up in the early part of 1942 it turned into the broad highway of virtually unlimited demand for the first time in America's history. Industry met the challenge, and for eighteen months the industrial machine roared ahead at constantly increasing speed, lifting munitions production from around $1,000,000,000 a month at the end of 1941 to over four billions at the 1942 year-end and to a peak of around $5,600,000,000 in December, 1943. Then the first cutbacks braked the machine as requirements switched from "all out" to specialized demand; but production held about unchanged at the top levels.

Although 1945 calls for still greater production speed on many items, the road is apt to be bumpy as the fortunes of war ebb and flow. The close quarter slugging of the armies on the Western Front and in the Orient have chewed up materials at a rate not previously envisaged by procurement officers. The life of many products under actual battle conditions is much less than the calculated expectancy. Accordingly, the widely publicized shortages of products now in the "must" column will be replaced by others when the war enters new phases.

The past year was one of invasion by land, sea and air. To meet the grand strategy for the many fronts upon which we have been advancing, landing craft was the number one program from January to May, 1944. Simultaneously, our aircraft program called for the production of bigger and heavier planes to reach out to the Japanese strongholds and to disrupt the German industrial centers. The increased demand for the larger plane upped the airframe weight of 1944 production approximately 50 per cent, although the actual number of planes produced has declined each month since May. Production of trainers declined to less than one-half the number produced in 1943 as our training program neared completion and we were able to concentrate productive effort on destructive power.

When planned invasions became a reality, needs were revealed for new weapons and more of the same weapons than the most careful planning had provided. Battle experience in Italy highlighted the need for more heavy artillery and spare cannon. The invasion of France stressed the needs for more heavy trucks and tires. As the number of men engaged on the European front increased and lines became further extended, requirements for inter-military communications naturally increased. Thus production requirements for dry cell batteries used in the walkie-talkie were stepped up. In addition, the

need for tactical field wire exceeded production and schedules were boosted. Tanks mounting bigger guns were put into production as a result of invasion experience.

Meanwhile the Navy's need for troop transports, transport attacks and cargo attack ships competed for priority in the early part of 1944. A faster cargo vessel, the Victory Ship, came into production in 1944 also, while Liberty Ship deliveries declined in number. Our landings also called for increased production of amphibious craft of all types, such as Alligators, Water Buffaloes, and Ducks—all tracked landing vessels.

The mounting tempo of the Japanese War has brought forth upward revisions of Navy Ordnance requirements, particularly high capacity ammunition for bombarding fortifications and softening up beachheads. Rocket production, too, has been stepped up, with schedules calling for another big increase. Uncle Sam's fleet almost doubled in size between December, 1943, and the end of 1944. This development naturally emphasized the requirements for ship maintenance and repairs. Outlays for this program increased almost 50 per cent in 1944 over 1943 with a continued high level indicated for 1945.

Long range planning for concentrated war production, paced by expanding shell requirements, will crowd steel mill facilities to capacity during the early months of 1945. Army and Navy pressure for early deliveries continues for flat rolled products, wire, bars and pipe. Steel plate demand, though lessening, continues urgent. Holes in various schedules occasioned by cutbacks and cancellations due to shifting demands have been rapidly filled up by other requirements.

An optimistic note from the point of view of supply is the more realistic attitude in placing orders, with a consequent lowering in the amount of "attrition." Attrition as it relates to steel distribution is defined by the Controlled Materials Plan statistical branches as the difference between claimant agency allotments and the orders actually placed against those allotments. At the beginning of 1944, steel orders placed were only 84 per cent of claimant agency allotments with an attrition, therefore, of 16 per cent. This attrition had dropped to less than 10 per cent at the year end. In establishing 1944 allotments the Requirements Committee had made some allowances for attrition to avoid loss of use of steel facilities. However, more balanced production schedules appear to be in prospect as the gap between claimant agencies' allotments and placed orders narrows.

The revised view of the war's probable duration is evidenced by the Army's stepped up demands for carbon shell steel extending throughout 1945. Shell steel production is expected to reach 400,000 tons monthly at the end of 1945. A large part of the additional tonnage will be needed for 105mm. and 240mm. shells.

Steel mill schedules must be reshuffled to accommodate the ammunition program. Expected increases in shell billets and other types of steel for the ammunition program will cut into first quarter output of quality carbon bars, semi-finished, rails and structural steel at some mills. Quality "Hot Topped" steel will be in increased demand for this program which may reduce supplies of quality steel available for the seamless pipe and tube mills.

In addition, as mentioned earlier, the "must" brass strip program which exceeds brass mill capacity by approximately 15 per cent may necessitate some use of steel strip rolling facilities for brass.

Cancellation of British Lend Lease orders which have been approximated 150,000 tons quarterly will ease the carbon semi-finished picture.

1945 Steel Estimates

Steel demand in the first two quarters of 1945 as estimated by requirements for the claimant agencies is expected to continue about unchanged from the estimate of 16,519,000 tons of carbon and alloy steel for the fourth quarter of 1944. These estimates were made on an "order offers" basis after allowing for attrition (assuming that 10 per cent of allotments would not be ordered).

The estimate indicates a drop in military requirements in the first quarter but this estimate reflects a drop in the Maritime Commission load for the first quarter and a still further decline in the second quarter which may not occur.

Adding in expected new Army demands, requirements for the first and second quarters are likely to be above the fourth quarter of 1944 and to tax to the limit operating facilities for most finished steel products.

Contrary to the general expectation, first quarter 1945 estimated allotments for Class B products and Class A Civilian Type End Products which were made with an eye to an early V-E day were somewhat less than the 4,000,000 tons of carbon steel allotted in the fourth quarter of 1945. Under the impact of the increased military program, it is possible that sizeable chunks of these allotments must be sliced off and diverted to prime war needs, except where mill schedules would be unduly disrupted.

In estimate of steel requirements for the first and second quarters of 1945 prepared a short time ago, demand had been listed on a "two war" and "one war" basis. The latter is now definitely out the window but it is interesting to note that the "one war" estimate indicated a war demand drop of only 1,000,000 tons quarterly in carbon steel and 500,000 in alloy steel. This difference presumably would go into civilian consumption, but even the indicated 6,000,000 ton annual increase for civilian production is less than 10 per cent of annual finished steel production in the United States. From this it can be seen that the war production drop when Germany is defeated is likely to be far less than previously anticipated by the public.

The conclusion to be drawn from the above, which cannot be brought out too emphatically, is that all producers of war goods should slow up on peacetime planning and exert all their effort and "know how" to meet the many difficult production tasks that now confront us.

Critical Steel Products

Heading the list of critical steel products on which WPB's Steel Division is bending every effort to increase production are shell steel billets. The many news stories in the press regarding this product would indicate that the tie-up was in the rolling facilities at the steel mills, but a review of the situation during the first ten months of 1944 indicates that the bottleneck lies further along the processing stage. The forge shops, for instance, have taken up their full allotments in only two of the first ten months of 1944. The bottlenecks then have been progressively in forging, machining, and loading. Delay in obtaining and installing new machining equipment, of course, has been a contributing factor.

To meet the needs of fast-moving troops and to replace the damage of artillery fire, assault, field and tactical communication wire requirements have gone up at an accelerating rate —much faster than the rate of production. Production of all types of tactical wire totalled 179,000 miles in November, within 3 per cent of the scheduled rate and 5 per cent over

October. The 1945 requirements have been raised 30 per cent above the current production rate.

Productionwise both manpower and facilities are short. The WPB Steel and Copper Divisions will shortly submit estimates required for new facilities upon completion of studies on the maximum standing capacity of existing facilities and new facilities soon to become available.

The recent big jump in requirements was in field wire. Production of this wire is limited by the fact that wire rope and aircraft wire are competing for use of the same facilities.

Wire rope and strand production have shown improvement for three successive months and recently topped the previous 1944 peak production established in May. Important military uses for wire rope and strand include winch cables for heavy trucks, cranes, power shovels, deck lashing, davit rope, arrester gear rope (on aircraft carriers) and other shipboard uses. Recent surveys of the Steel Division indicated that wire rope and strand output could be increased by some 4,000 tons monthly if 1,500 additional workers were available.

To eliminate the serious tie-up in vital castings production, an "identification" program has been set up by the War Production Board through which it will be possible to pick out castings orders for critical end products and give them first claim on facilities and manhours. To this end, Army Ordnance and EPCO (Bureau of Ships Engine Parts Coordinating Office at Detroit) will (1) identify contracts for "must" programs, and (2) instruct contractors to put end-product identification on their orders to subcontractors and through the prime contractor, instruct them to pass the identification along to the foundries. Meanwhile EPCO has been going into contractors' plants—chiefly engine part plants to trace the orders placed on the foundries and forge shops down to critical parts orders. After that it will notify the Steel Division of what orders have been placed and the sequence in which they should be delivered.

Aside from the over-all problem of obtaining program identification, the task is to achieve maximum utilization of foundries capable of casting the larger and more difficult types of products. Here manpower is a bottleneck. A number of critical foundries and forge shops now obtain preference in labor referrals. To ease the situation further, the Army recently agreed to furlough 1,000 men. The Navy has also agreed to grant furloughs for this purpose.

In alloy steel, production appears to be adequate to meet indicated demand although there have been increasing indications of tightness in such alloying elements as manganese and chrome.

The manganese situation has been eased somewhat through agreements reached with the trade to use only 50 per cent of the Grade A classification during the first quarter of 1945. Here the accent is on shipping space as the Grade A ores are imported mainly from West Africa, India and Brazil. Chrome is in a similar situation with shippers agreeing to take part of their requirements in Grade B to relieve the demand for Transvaal ores from South Africa. The outlook for nickel, tungsten and molybdenum is that there will be a sufficient supply in 1945 to meet all the essential needs.

The superimposed artillery ammunition program on top of the small arms program will require an additional one billion pounds of brass mill strip in 1945. This new need boosts the total 1945 requirements to 4,270,000 pounds against existing brass mill facilities of 3,808,000 pounds. The deficit must be made up through cutbacks in industrial and building uses of brass strip, conversion of brass mills to produce more strip and some use of steel mill facilities for brass strip. Approximately 15,000 additional skilled workers will be needed. Our good neighbor Canada has signified her willingness to loan brass mill facilities and the offer has been gratefully accepted.

Most brass mills and many copper wire mills are located in very critical labor areas and for that reason it may not be possible to recruit addi-

(*Concluded on Page* 196)

Controlled Steel Products

Claimant Agencies—Net Shipments by Grades Including Castings

January-October, 1944

All Grades, Net Tons

Agencies	Carbon Grades, Jan.-Oct.	Alloy Grades, Jan.-Oct.	All Grades, Jan.-Oct.
Aircraft Resources	377,370	747,000	1,124,370
War Department	9,439,364	1,776,455	11,215,819
Navy Department	5,654,479	1,368,271	7,022,750
Maritime Commission	6,731,581	45,030	6,776,611
Lend Lease	2,460,194	190,950	2,651,144
Economic Warfare	1,027,188	22,422	1,049,610
Canada	795,413	53,811	849,224
War Food Admin.	3,135,702	65,044	3,200,746
National Housing Admin.	56,914	60	56,974
Petroleum Admin. for War	1,302,549	246,990	1,549,539
Rubber Director	102,173	7,141	109,314
Defense Transportation	4,151,099	40,390	4,191,489
War Utilities	730,607	67,207	797,814
Fac. Bureau Misc. Non. Prog.	332,792	2,416	335,208
Operations Vice-Chairman	9,991,966	1,368,569	11,360,535
Civilian Requirements	84,857	1,478	86,335
Aluminum Div. Expan. Pg.	13,085	267	13,352
Steel Division	81,146	2,755	83,901
Total Claimant Agencies	46,468,479	6,006,256	52,474,735
Small Orders	103,029	4,945	107,974
Maint. Rep. and Oper. Supplies	1,570,945	100,249	1,671,194
Miscellaneous	1,540,366	8,406	1,548,772
Total Net Shipments (Inc. Ship. from Whses.)	49,682,819	6,119,854	55,802,673

W. P. B. Steel Division—Control Branch.

Pouring blister copper from a converter at the Anaconda plant. Copper's war record is one of gutting the few remaining domestic deposits.

Nonferrous Metals

Germany's lost grip on stolen resources premonishes disaster. Meanwhile, as America suffers serious depletion of its rich reserves, the brakes are slammed on the bulk of current domestic production to avoid a stockpile avalanche that will depress postwar markets.

By Charles T. Post

SCARCELY a week after German armies marched over the Polish border into Silesia in September, 1939, they had taken Europe's richest zinc mines, with ore averaging 17 per cent. The mines were down for a day or so—not long enough for what Americans would class as a full fledged strike—and back they went into operation with fully trained German supervisory crews.

The story since has been similar in nearly all important mining camps of the world taken by the enemy. American mining engineers in the Philippines sabotaged equipment as best they could, but the Japs had replacements on early boats enabling them to resume the mining of gold, outlawed in the United States as a wartime luxury.

The tale of the turn of the war in metals magnifies the importance of the time element in the flow of metals from ore to ingot to end product to scrap—and back to the melting furnace—and the importance of stockpiles in a war of attrition. The principle of the "pipeline," which is time lag factor between the time raw material goes into stock or process and emerges fully fabricated and finished, has been of considerable importance in the U. S. supply situation. In some cases "pipeline" needs have resulted in construction of considerable production capacity which, it later turned out, was only needed to prime the flow, not to keep it going.

There have been scoffers who have insisted that Germany must have tremendous stocks just because her armies failed to collapse the moment her raw material sources were wrested from her. Oil continues to gush forth at the Atlantic seaboard several days after the last drop has been pumped into a pipeline at Texas, but eventually and suddenly ceases altogether. So it is with metal in the industrial structure of a nation.

For instance, loss of tungsten resources in the Iberian peninsula means a stringency in tool steel production, but tool steel is at the far end of the production parade from most of the finished products which are the sinews of war. Some metals have as many lives as a cat—and it must be admitted that German science has raised the normal life expectancy tremendously—passing from primary to secondary through a whole series of re-refinings, but sooner or later contamination and expendability take their toll and the pipeline runs dry. While it flows its fluid may be diluted, but when it ceases pumping will not start it again. It is notable that the plan to prevent Germany from getting a head start on another war, propounded by the heads of leading American technical societies and viewed with considerable favor generally, is not to police assiduously her industrial machine but to control her raw material supply—to see that she is unable to prime the pump that starts the pipeline.

Though her armies still fight fiercely, the input on the German metal pipeline has slowed to a trickle. Loss of Nikopol, the Balkans and Hungary, has reduced the 1943 supply of about 350,000 tons of contained manganese to a maximum yearly rate of approximately 70,000 tons, FEA estimates. Turkish chrome which once provided 30 per cent of German requirements now flows to the Allies, and loss of the Balkans has eliminated practically all the rest. (When Turkey stopped shipments in April, she had received Nazis supplies worth 170,000 tons of chrome under her barter agreement. but had shipped only 15,000 tons of ore, the New York *Times* reported.) Spain, which maintained an embargo on tungsten exports through February, March and April, 1944, agreed to cut shipments to 20 tons a month in May and June and 40 tons a month for the balance of the year. On June 5, Portugal agreed to shut down her tungsten mines, producing an estimated 6000 tons annually, and cease export. Thus the Iberian flow was cut to a trickle, and finally the liberation of France sealed the leak. A strip of nickel ore 1¾ miles wide and 28 miles long at Petsamo, Finland, was being developed when the war broke by an International Nickel Co. subsidiary under a 40-year concession granted in 1934. Loss of Petsamo leaves Germany with an output of about 1000 tons, principally from Norway, equivalent to little more than 10 per cent of her 1943 supply, FEA asserts. Loss of molybdenum from Finland, Greece and Yugoslavia represent about two thirds of total German supplies, approximating 650 tons, and Norwegian mines have been bombed. Finnish cobalt, which represented about 80 per cent of total supplies leaves only domestic production obtained as a by-product of synthetic oil manufactured.

High grade bauxite deposits in southern France furnished about 40 per cent of ore available to the Reich and the French aluminum industry provided about 15 per cent of total aluminum produced in German Europe, the British estimate. Yugoslavia, Europe's principal bauxite source, brings the German resources about 50 per cent of last year, but rail shipments have been somewhat disrupted, it is reported.

The largest European copper mines were Outokumpo in the Karelian peninsula and the Bor mine in Yugoslavia. These are gone, cutting off about 60 per cent of German supply. Primary lead supplies have been cut approxi-

mately 40 per cent by the loss of Yugoslavian and other Balkan mines, according to British figures, but it is noticeable that a greater blow is counted as the loss of substantial amounts of scrap being collected in conquered western Europe.

Just what proportion of German metal output has come through wholesale confiscation of all sorts of conquered metallic loot it is difficult to estimate, but bits and pieces of information indicate that it must have been considerable. Recent Dutch dispatches tell of confiscation of silverware to be melted for industry, an indication that the Nazis have been finding some of the same remedies as we for lack of tin.

Meanwhile, in the United States, 1944 was chiefly memorable as a year in which the metals industry found that its production pipeline and those of its Allies were filled, and that the amount of material needed to keep war materiel spewing out the other end was far less than capacity provided. Some industries were beginning to worry for fear the material in the pipeline at the end of the war would be so large as to flood them temporarily, drowning some of the less efficient units.

Four years ago, almost to the day, an obscure IRON AGE item reported that Edward R. Stettinius, Jr., then commissioner in charge of the industrial materials division, National Defense Advisory Commission, had declared that "Investigations just completed disclosed no serious shortages of aluminum supplies for aircraft and other military items now required for national defense." Primary metal production at that time was at the rate of about 600,000,000 lb. annually. Within a few weeks, because it could not be quarantined from consuming industries whose physiognomies were swelling almost beyond recognition, the aluminum industry caught the mumps itself and was puffing up to a capacity of 1,100,000,000 lb. Came the war, which had the effect of arbitrarily doubling anything for which a more reasoned approach was unavailable, and the projected capacity became 2,200,000,000 lb. a year. This amount never has been achieved over a 12 month period, and probably will not be for many years although production was at approximately that rate during the last three months of 1943. Then, because military and lend-lease requests proved to be little more than fuzzy estimates, came the ax. Primary aluminum production in 1944 was about 1,500,000,000 lb., still somewhat apace of consumption, and nearer the revised prewar capacity goal than the final expansion program whose ultimate target, it is suspected, never was pinned down. Secondary aluminum ingot produced from scrap in 1944 was about 600,000,000 lb., approximately equal to the country's entire new metal capacity at the time of Stettinius' statement.

Calling the roll, reduction works at Maspeth (Queens) N. Y., Burlington, N. J., and Riverbank, Calif.—DPC owned, Alcoa operated—have been closed down and declared surplus. Reduction plants at Torrance, Calif. (Alcoa-DPC), and St. Lawrence, N. Y. (Alcoa-DPC) have been closed down and placed in stand-by condition. Alcoa-DPC plants at Spokane, Wash., Troutdale, Ore., and Jones Mills, Ark., and Alcoa plans at Badin, N. C., Vancouver, Wash., and Alcoa, Tenn., have been curtailed. Only plants still in full scale operation are those of Reynolds Metals Co. at Listerhill, Ala., and Longview, Wash., and a DPC plant operated by Olin Corp. at Tacoma, Wash.

Though the smallest plant in the country (annual capacity 40,710,000 lb.) the Olin plant is possibly the most significant from the standpoint of the future, for it utilizes—as well as surinam bauxite—alumina produced at Salt Lake City from Utah kalunite clay. For this reason, it is the only DPC plant in the country kept in operation. Bugs abounded in the process when originated, most of them at the Salt Lake City end, but gradually they have been exterminated, and costs are being reduced to the point of respectability. At Salem, Ore., construction is underway on a pilot plant to be operated by the U. S. Bureau of Mines which also will focus its attention on West Coast clay deposits, experimentation centering on the ammonium sulfate process. A fortnight ago, Aluminum Ore Co., Alcoa subsidiary, formally opened its East St. Louis, Ill., development laboratory, which will actively seek to perfect the soda-lime-sinter process to utilize low grade Arkansas bauxite as well as reclaim alumina from red mud waste.

Ferdinand the Bull of the aluminum situation is aluminum scrap, a different breed of beast from other nonferrous scrap, because alloyed or impure scrap cannot be refined in the sense that copper is refined from brass. Thus there is a constant tendency each time secondary metal is melted down to build up a heterogeneous mixture of alloying elements and impurities in certain types of alloys. In 1942, when the new metal plants were straining to satisfy consumption, WPB protected the pucidity of secondary aluminum by placing severe restrictions on the melting of aluminum scrap and strictly policed segregation of scrap by producers. Came the deluge of new metal, and scrap became a drug on the market. In 1943 government support was necessary to prevent demoralization of the scrap price structure. This support was gradually withdrawn, and government purchases of secondary ingots ceased altogether Sept. 22, 1944. At the same time, mandatory segregation and restrictions governing sales and melting of scrap were eliminated. Having vanquished the matador of scarcity, Ferdinand has been retired to pasture, but probably only temporarily. The final chapter in the saga of secondary aluminum will only be written when adequate manpower permits the return to full scale civilian production. Then, with price as a key, it may unlock a secondary ingot market running as high as 1,000,000,000 lb. per year. Supplies of aluminum scrap will be bounteous in the immediate postwar years, probably half comprised of that pariah of the remelters, wrecked or obsolete aircraft. Because of the impossibility of segregating alloying elements, the determining factor as to whether the secondary industry can fulfill its promise lies in segregation.

Progress has been made by the remelt industry within this hardnessing scope. Magnesium content can be reduced at will from high percentages to 0.03 per cent or below. Satisfactory tensile strengths have been obtained on secondary aluminum alloy. but satisfactory elongation has caused more difficulty because of the higher percentage in variety of constituents other than aluminum. This difficulty is being overcome to a degree by modification of heat treatments which heretofore have been those specified for primary alloys. Gas, particularly on high silicon alloys, has been another objection, but one refiner has adopted a vacuum pouring method designed to remove this influence.

With high grade bauxite stocks dwindling, thus tending to raise costs of primary metal production, and with less rigid specifications for many civilian products, the secondary industry bids fair to win wider attention and benefit the nation through conservation of resources at the same time.

Manpower now remains the sole barrier to large scale resumption of civilian production, following removal of most aluminum use restrictions July 15. When this barrier is sprung, the industry will have a clear track

to finding its place in the peace time field.

The magnesium story is a carbon copy of the aluminum thriller with different names and places. Primary metal production hit its all time peak in March, 1944, when 41,015,000 lb. was produced. Thereafter, repeated curtailments and plant closings gnawed away at production statistics. The 1944 production of primary metal wound up in the neighborhood of 330,000,000 lb., compared to 367,168,000 lb. in 1943.

All of the big government owned plants are shut down or heavily curtailed, some of them never having reached full production. Basic Magnesium, Inc., at Las Vegas, Nev., which had so many employees that it could swing any political election in the state, is in stand-by condition, pending partial use for other government purposes. The Ford plant at Dearborn, and Mathieson Alkali at Lake Charles, La., both have been closed and declared surplus property never having fully achieved their promise. Electro-Metallurgical at Spokane, Wash., Kaiser's ferrosilicon process plant at Manteca, Calif., Dow at Marysville, Mich., and Velasco, Tex., International Minerals & Chemical at Austin, Tex., and Amco Magnesium Corp. at Wingdale, N. Y., all are down and in stand-by condition.

Only four government owned plants —New England Lime at Canaan, Conn., Magnesium Reduction at Luckey, Ohio, and Diamond Magnesium at Painesville, Ohio—are in partial operation, because of important by-products. These all are smaller plants. This leaves the field to two private operators, both going as best they can under present conditions, both symbols of might in American industry. The race which promises to develop should be a thriller. Early operating difficulties conquered, Henry J. Kaiser has high hopes for the Permanente Metals plant 40 miles southwest of San Francisco. Holding the advantage of prewar dominance in the industry.

Since mid-July, there have been no restrictions on the use of magnesium in other than ingot form, and this control went by the boards early in October. Civilian users were free to step up and take a shot. The only hitch was that with the transportation industry, at which the magnesium makers have been ogling, engrossed in war products, there were no big civilian users. Aircraft still took 90 per cent of the output. Thus the industry's postwar problem looms clearer perhaps than that of any other metal —create markets. With over a hundred companies engaged in various types of fabrication, the Magnesium Association was formed in March to ponder this puzzler. Uses suggested right off the bat: portable tools, truck parts, railway car parts, radio parts, conveyors, wheels, office equipment, exhaust fans, household appliances.

Diapers to Training Pants

Because it volatilizes readily, magnesium scrap can be refined readily to produce high grade secondary ingots. During 1944 secondary magnesium went from diapers to training pants, being produced at an average rate of approximately 2,500,000 lb. per month throughout the year compared to a total of 22,804,000 lb. in 1943, and 12,566,000 lb. in 1942. With primary metal production reduced from a rate of 15,000,000 lb. a month to 7,500,000 lb. a month this year, secondary metal production will be at a rate of approximately one third as much as primary. Metallurgical tests on secondary magnesium ingot thus far have been relatively few, but are extremely promising—provided confusion in the public mind associating it with the limiations of secondary aluminum can be erased.

Government held metal stocks are something of a mystery. Apparently

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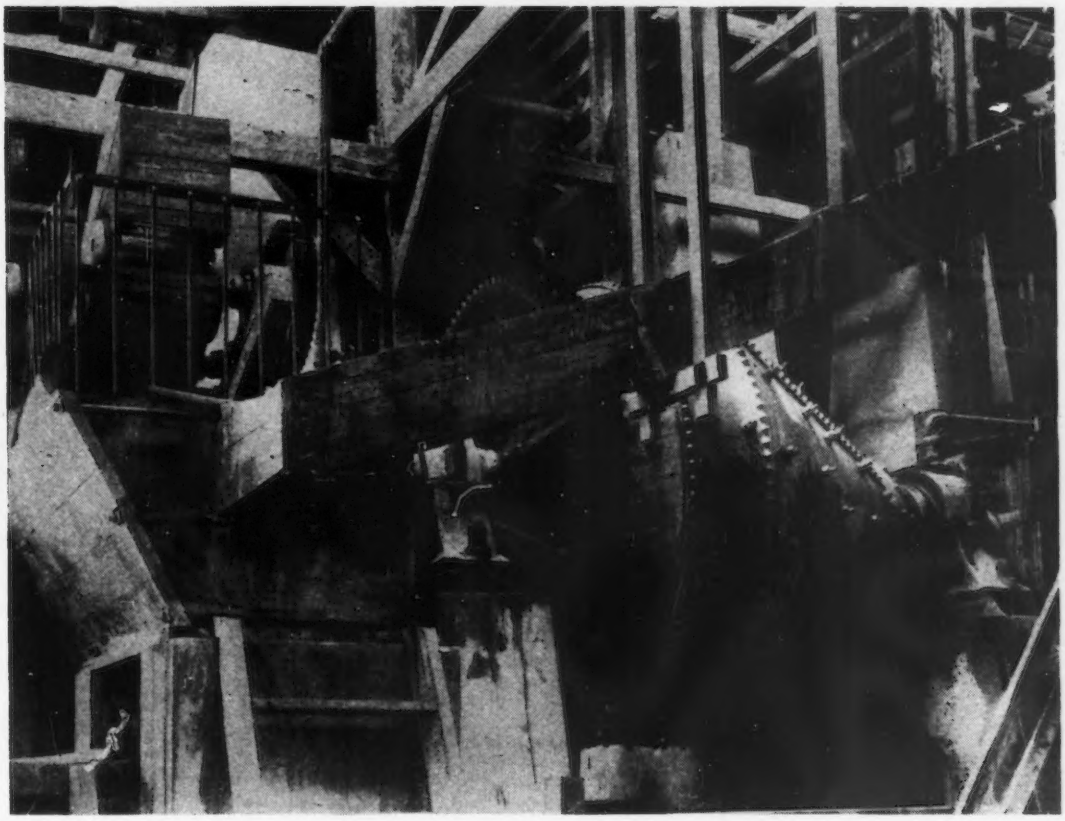

NETHERLANDS East Indies tin ore dressing plants, like this one of the Billiton Tin Mining Co., are in Jap hands, and the Allies have scant chance of getting them back intact.

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Wider appreciation of the fundamental nature of steel hardening through isothermal transformation and related studies has resulted in a more complete realization of the latent properties inherent in steel. However, the age-old carburizing process, as pictured here, continues to be the standby of the steel treater.

Ferrous Metallurgy

Innovations and improvements in steel making and working, boron-treatment, heat treatment, welding, and high-temperature alloys add up to a rather satisfying picture of metallurgical progress which will have immediate peace-time benefits.

By E. S. Davenport*

PERHAPS one of the most significant, although, as yet, far from completely "crystallized" trends in ferrous metallurgical thinking during the past year has been the increased tendency, or at least a more favorable attitude, toward buying and selling steel on the basis of desired performance and properties rather than solely on the traditional basis of chemical composition. The customer should be, and usually is, more interested in how the steel he purchases will perform in fabrication, treatment and service than in just how much carbon, sulphur, phosphorous and alloying elements may be present in the material as shown by a chemical analysis. The particular property of interest may be a depth or range of hardenability, ease of machining, suitability for welding, oxidation resistance or some other combination of properties favorable to service under a specific set of conditions. In any one of these cases there would, undoubtedly, be several compositions that would serve equally well. Both the customer and the supplier are becoming increasingly aware of the advantages of a mutually satisfactory solution to such questions on the basis of properties, availability and economics rather than upon the arbitrary basis of chemical composition alone. This is not to say, however, that chemical analysis is to be abandoned, as one of the yardsticks for evaluating the suitability of steel for a given purpose; it will probably always remain as *one* of the important criteria.

An example of this sort of trend is the gradual realization that the NE steels, and many other so-called "substitute" or "equivalent" ferrous materials, have done an outstanding job in the war effort when many of the older, more familiar steels were either scarce or not available at all. While it is true that many of these "substitute" steels did not have the lavish margins of safety possessed by the older materials, and thus had to be handled more carefully in fabrication and treatment, nevertheless these "substitute" steels were found to be entirely adequate, on the basis of actual properties developed when suitably treated, regardless of what the chemical composition happened to be. The "equivalency" of these newer steels to the older, more familiar materials, has been the subject of considerable discussion, but it has been demonstrated beyond much doubt that when comparisons are made on the basis of actual properties developed, chemical composition, within given carbon ranges, had little effect on mechanical properties, provided full hardening had been achieved.

The recent promulgation by the American Iron and Steel Institute and the Society of Automotive Engineers of "Tentative Hardenability Bands" for certain grades of alloy steels is another indication of the trend toward a "property-conscious" attitude in specifying and purchasing steel. While this development has been received with reserve in some quarters, as might be expected, and while it is much too early to venture a guess as to how wide its acceptance will ultimately be, the very fact that such hardenability bands were devised and issued by a joint committee of steel users and suppliers, implies a certain community of thought along these lines that may indicate the future trend.

Continued study of the physical chemistry of the primary steel-making processes—open hearth, electric and Bessemer—has proceeded in spite of man-power shortages and the inevitable curtailment of experimental programs because of pressure for war production. These studies involve such matters as better regulation and control of metallurgical reactions in the furnaces, slag composition, temperature measurements, degree and method of deoxidation and numerous others, all leading to greater refinement in practice and better uniformity of product. Concurrent with such studies has been the continued development and improvement of many types of control and recording instruments which are now so well established in the steel-making shop that they are taken for granted as much as the cranes or the ingot molds. Such instruments range all the way from automatic fuel control equipment based upon measurements of the open hearth roof temperature to spectroscopic equipment for estimating the end-point of the Bessemer blow or special devices for measuring and recording the temperature of the molten metal while it is still in the furnace. Many of these instruments and techniques are still in the early stages of development, but accelerated effort along these lines may be looked for as soon as the pressure for war materials eases to some extent.

These admittedly undramatic, but none the less important activities are mentioned because of their fundamental bearing upon all steel-making processes and products. Practically all grades of steel are benefitted by the quiet step by step advances which are continually taking place in this field of endeavor, but which rarely, if ever, make the front-page headlines. In a similar, unheralded category is the very considerable amount of effort which has gone into research

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and development on the washing and preparation of certain metallurgical coking coals and studies on the beneficiation of iron ores. Such activities look to the long-range future and constitute an attempt to anticipate some of the problems which may confront us in the not too distant future when our raw materials may be of a lower grade than we now have at our disposal.

Another favorable consequence of these developments, frequently overlooked because of its unspectacular nature, is a direct by-product of the vast war-time expansion of the steel industry. This is the circumstance that the great increase in steel plant capacity has brought into being some of the finest and most modern equipment ever devised for the creation of steel products; these incorporate the latest developments in mechanical, metallurgical and electrical engineering. Used intelligently in the post-war period, this equipment should turn out products that for uniformity of gage, contour, quality and surface finish would have been thought impossible only a few years ago.

Boron-Treated Steels

The so-called "intensified" or boron-treated steels are those to which boron, in minute quantities, is added to the molten steel, after deoxidation, by means of one of a variety of commercially available special addition agents. The chief effect of the residual boron, which is present to the extent of only a few thousandths of one per cent, is to enhance hardenability, i.e., to increase depth of hardening. Practical studies on many grades of "intensified" steels have continued throughout the year, the main emphasis being on the effect of the various addition agent as reflected in mechanical and other propties of typical carbon and low-alloy steels. Further fundamental studies have also continued on the exact mechanism by which the boron accomplishes its rather remarkable increase in hardenability. Most of the work in both categories is of such a nature that it cannot yet be discussed in detail. It can be said, however, that substantial progress has been made toward a better understanding of the metallurgical behavior of these steels, although much remains to be learned about the metallography, deoxidation and reproducibility of boron-treated steels.

There is no doubt that these steels have made a definite contribution to the war effort in affording a means of conserving the scarce, metallic alloying elements ordinarily used to increase hardenability. In addition, this whole development of "intensified" steels has opened up a relatively new field to intrigue the ferrous metallurgist in the years ahead; namely, the study of the effect of minute quantities of certain alloying elements on the properties of this basic material. The nonferrous metallurgist already knows his way around in this subject to some extent, but the steel metallurgist may have an interesting and fertile field before him if he grasps the opportunity.

Heat Treatment

Both the science and practice of heat treatment have continued to forge ahead during the past year. Some of this progress is directly attributable to the many special problems arising out of war activities. On the other hand, many of the new practices in heat treating are solidly based on extensive programs of what might be termed "pure research" on the fundamental aspects of the subject—programs which were carefully planned and persistently nursed along over a period of many years. The industry is now beginning to harvest the fruits of these researches in the form of improved heat treating techniques and a more rational approach to the whole subject of heat treatment of ferrous materials.

Space limitations preclude a detailed discussion of any of these subjects, but a few, selected at random, will be mentioned as typical instances. For example, a wider appreciation and understanding of the fundamental nature of the hardening of steel through isothermal transformation and related studies have led to a vigorous and widespread application of these principles in the form of improved hardening techniques involving the use of molten salt baths and other forms of elevated-temperature, or so-called "interrupted" quench procedures; austempering, martempering, time-quenching, hot oil quenching and various modifications of these come to mind as examples which have received attention in recent months.

These newly-devised heat treating schedules with their numerous modifications and adaptations, tend to reduce scaling, decarburization, distortion and cracking; they yield better combinations of ductility or toughness for a given hardness or strength and, in general, result in a more complete realization of the latent properties inherent in the material, the properties that are always there but awaiting appropriate heat treatment to make them usable by the designing engineer or other potential user.

Hand in hand with these developments have come improvements in design of heat treating furnaces, advances in the field of controlled atmospheres and continued development of instruments and devices for helping the heat treater to do a better job and turn out a more uniform product. High frequency and megacycle induction heating have come in for their share of intensive development and are now firmly established in the commercial heat treating field alongside the older and more conventional methods of heating; at least one elaborate installation for heat treating bars by high frequency induction, on a continuous basis, has been described in the literature. Although not exactly in the category of *heat* treatment, the subject of refrigeration of tool, die and related steels for improving their stability and life has received considerable attention during the past year; most promising and practical results are reported. Substantial progress has been made in the understanding of how to heat treat for the best combination of properties in some of our heavier steel products such as plates, castings, forgings, etc. Much of this understanding stems from the rapid accumulation of reliable data and better grasp of the quantitative influence of alloying elements on hardenability, all of which has resulted in more efficient use of these alloys. However, there have also been notable advances in the design of special heating, quenching and handling equipment for many of the heavy heat treated products resulting in improved over-all quality and savings in cost.

All of these new heat treating developments have been applied on an extremely wide variety of war items ranging all the way from heavy masses of steel to bullet cores and from rocket bodies, bayonets and cartridge cases to machine gun and rifle parts with such close dimensional tolerances as to be almost in the watch-maker's class of goods. The experiences gained on these products should be most helpful in solving many heat treating problems in the peace-time years ahead.

Welding Problems

The war involved industry in a large number of steel structures in which welding was clearly indicated to be the preferred method of fabrication. The difficulty was that many,

if not all, of the steels involved were of a nature which, until quite recently, would have been considered entirely unsuited to commercial welding operations. Efforts, on an almost Olympian scale, involving the cooperation of steel suppliers, fabricators, electrode manufacturers, the armed services and many other government and private agencies resulted not only in a solution of the problems, but an accumulation of welding knowledge and experience that might easily have taken a generation to acquire under normal circumstances. Details cannot be disclosed at this time, but it is safe to say that many welding problems can now be approached with equanimity and reasonable hope of success that only a few years ago would have been dismissed as too fantastic for consideration. This is a cheerful outlook, since it seems quite clear that welding, as a method of fabrication, is due for still further expansion, notwithstanding the great strides it has made in recent years. The study of residual stresses after welding has become an extremely active subject lately and the large number of workers concerned with investigating the various aspects of welding assures that the whole subject will continue to receive the attention it deserves.

The accumulation of data on the properties of steel at elevated temperatures is a slow, arduous and costly business. Within the relatively short space of a year it is often difficult to see much tangible progress, for the simple reason that it may take that much time to explore, even in a cursory manner, the possibilities of a single composition. Nevertheless, designers and operators of oil refineries, chemical plants, steam power plants, aircraft engines, gas turbines, etc., are not ordinarily content to sit down and wait patiently for the results of long-time "creep" tests; their demand for steels to resist higher and higher temperatures, or pressures, or more corrosive conditions is usually well ahead of the materials that are commercially available at any given moment.

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EXTENSIVE metallurgical programs are under way to meet the urgent demands of gas turbine designers for superior alloys to stand up under the very severe service conditions. This is Bell's twin-engine jet fighter, the first of a long line of military jet craft from many plane and engine makers.

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High Temperature Applications

However, considerable progress has been made within the year in surveying the field and getting a better perspective on the materials that are presently available for high temperature service. Extensive programs have been, and still are under way looking to the development of superior materials for the very severe service conditions encountered in gas turbines, super-chargers, and similar items of special equipment; progress can be reported, although war restrictions preclude detailed discussion at this time. Considerable attention has been given to studies of the structural changes which may take place in steel during extended periods of service at high temperature, as in the piping system of a steam power plant. While the general principles are now fairly well understood, much remains to be learned about specific types of change which it would be desirable to avoid; for example, about the factors controlling the reactions leading to graphitization, a form of structural change that may take place, particularly near welds, in certain types of steel upon relatively long exposure to elevated temperature. The important factors in this particular problem are being sifted out and subjected to intensive study, looking to the day of complete elucidation.

The more highly alloyed stainless and heat resistant steels are, of course, almost in the class of standard steels when it comes to high temperature applications. These steels are constantly under investigation for improvement of quality, properties, and uniformity and new alloy combinations are being developed for specific purposes as the occasion demands. Although it might seem that the metallurgical cream had been skimmed off this group of steels, since they have already become so well standardized, new combinations and proportions of alloying elements are continually being scrutinized in the effort to develop superior materials for increasingly severe service at both ordinary and elevated temperatures.

As is well known, much of the

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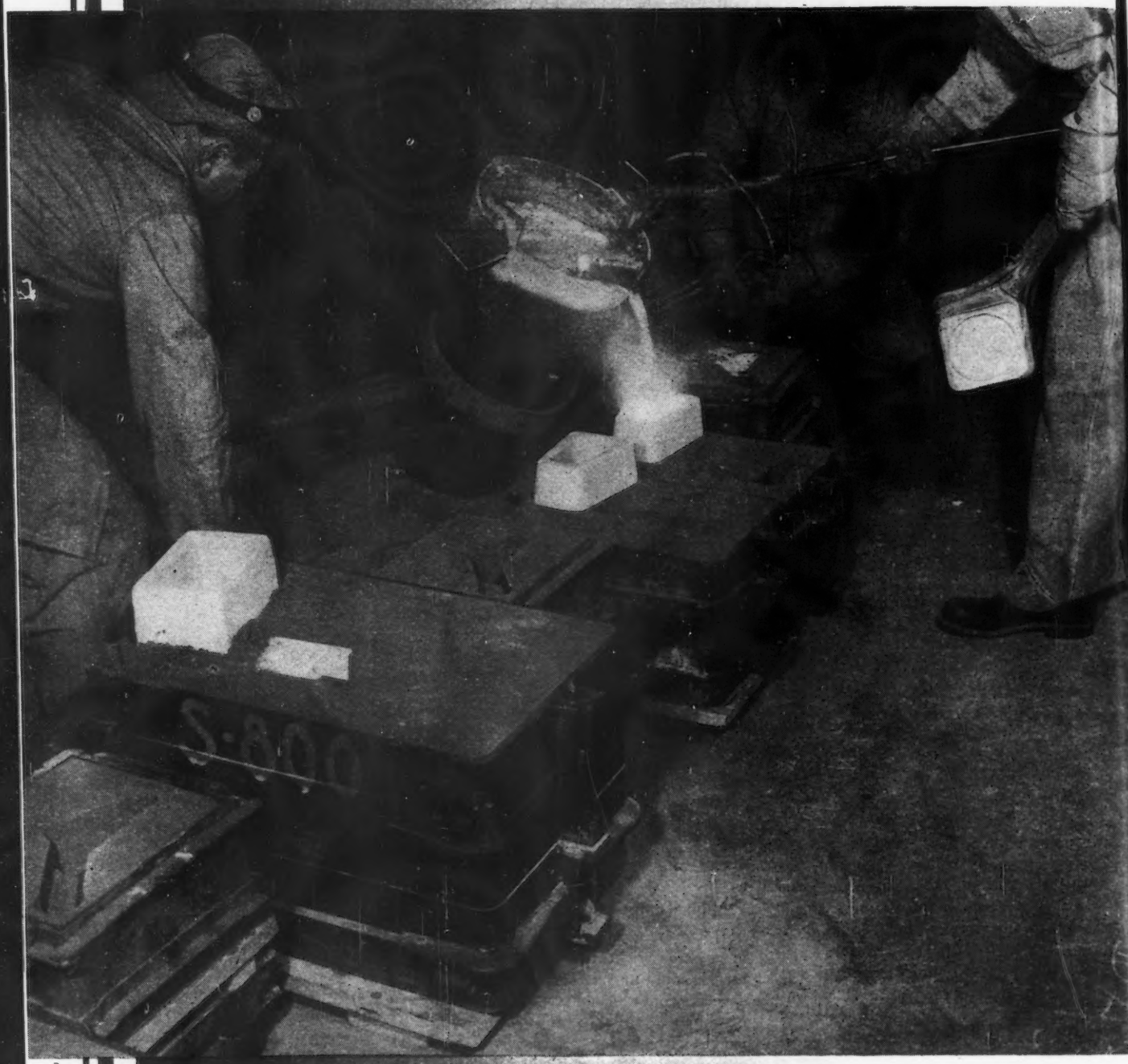


Casting magnesium in green sand molds in an experimental foundry. New methods are being devised to refine the grain size without resort to the cumbersome superheating treatment.

Nonferrous Metallurgy

New alloys and improved surface treatments are winning the light metals an excellent postwar competitive position. The minor or unusual metals are enjoying a spurt in application, and new treatments for copper and new bronzes attract favorable attention.

By Bruce W. Gonser and R. I. Jaffee*

RAPID wartime shifts in metal needs are nowhere illustrated better than by magnesium. From the frantic production expansion and new plant building program of 1942-1943, largely representing a U. S. Government investment of $500,000,000 in plant and $15,000,000 in fabricating facilities, a peak in production was reached early in 1944 which far exceeded requirements, even though all plants were not at maximum capacity. The recession from a production of about 80 times the prewar rate meant closing many of the high-cost plants owned by the Defense Plant Corporation before the end of the year. Now a couple more ghost towns seem in the making. This has not been from shortcomings of magnesium as a metal, but largely because the needs for magnesium in incendiary bombs did not live up to early expectations.

Aluminum, likewise, struck a wartime high in production from which somewhat curtailed operation and an abundance of ingot metal has resulted. This has brought about what would have been considered the height of absurdity two years ago—serious suggestions for use of aluminum foil for bread wrappers and for certain other packaging to replace paper. Incidentally, recent progress in making aluminum foil and in finding useful everyday applications for it brings visions to the manufacturers of a roll in every home (in the kitchen), as a peace-time necessity. Release of over 3000 tons of aluminum for experimental can production during the year is indicative. The thinking with both magnesium and aluminum now is definitely development of peace-time uses and utilization of the excess capacity.

Most of the other nonferrous metals continued at high production rates, but with the pressure off. Only tin, cadmium, chromium, and sodium have remained listed as insufficient for war plus essential industrial demand. Of these, tin is unique in that it continues to be used at a higher rate than production, or, in this case, than the amount imported. Fortunately, the total present stocks of around 113,000 long tons will continue to permit for several years deficits of 12 or 13,000 tons, the current rate, before a balanced account becomes essential.

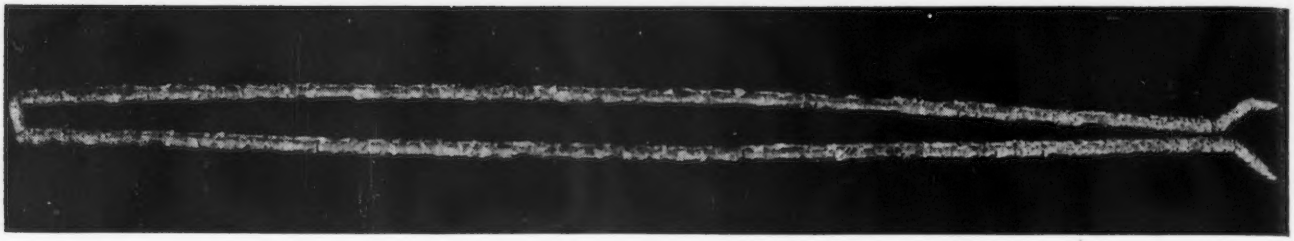
Unusual demands, stimulated by war activities and sometimes by not too much attention to costs, have been a godsend to some of the minor or unusual metals. Tantalum, for instance, has quickly graduated from the grams class to production figures of many thousands of pounds, and the tonnage of ores imported is beginning to look impressive, even though nearly all currently arrives from distant countries by plane. Aside from the huge amount used in making tantalum carbide and alloy cutting tools, an increasing volume is now moving into sheet, rod, wire, and fabricated parts for the chemical industry and for electronics equipments. A cost of six or seven times that of silver is easily compensated by the corrosion resistance, heat resistance, and "getter" properties of tantalum. One of the most interesting applications, newly developed, has been the use of tantalum in surgery as a structural material to replace bone, as a sheath to control growth of severed nerves, and as fine wire for sutures.

Metallurgically, tantalum is typical of that class of high melting elements, including columbium, tungsten, and molybdenum, where powder metallurgy is essential to secure the massive metal, and where special technique in high temperature sintering, special atmospheres, vacuum annealing, etc., are reaching a high state of efficiency. These metals are being considered more and more, along with chromium, cobalt, and nickel, in the rapidly moving field of alloys for high temperature requirements. Because of difficulties in machining, those alloys in this general class, which can be melted and cast are being handled increasingly by precision casting methods—a modern extension of the technique developed for making dental and jewelry castings.

Pure ductile zirconium is now in commercial production at the modest rate of nearly a thousand pounds per year. It sells currently for slightly less than gold, but indications are that the price will drop as the market grows, since the supply of raw material is abundant. Chief interest metallurgically now is the method of production, i.e., deposition on a hot filament in vacuum from the volatilized tetraiodide, and in evaluating the excellent properties of this easily worked, corrosion resistant metal.

Germanium entered the list of available metals in terms of hundreds of pounds in place of grams. Of particular interest has been the study of the gold-germanium alloys which have a low melting eutectic at 356 deg. C. (673 deg. F.). Several commercial applications seem promising. There has been some increased demand and production of gallium, also. This has been largely because of its tendency to reduce drastically the melting range of alloying metals. Indium still finds its greatest application as a thin electrocoating on the silver lining for aeroplane engine bearings, but new uses are being sought. Production easily exceeds consumption at present.

* *Supervisor and Research Engineer respectively, Nonferrous Metallurgy Division, Battelle Memorial Institute, Columbus.*



PURE ductile zirconium, produced as a quarter-inch diameter rod on a hot filament in vacuum. Although composed of large crystals having brilliant reflective faces, this material can be drastically cold worked.

Beryllium continues to be almost indispensable in making many copper products having springiness and resistance to fatigue. Its effectiveness in hardening and strengthening nickel has also been well demonstrated, but applications with the light metals in general have been disappointing.

New high strength, high yield, aluminum alloys with hot precipitation hardening characteristics have been announced recently by both Alcoa and Reynolds. German investigators have also announced new alloys of this type. Alcoa has not released the full composition of their Alloy 75S, but mentioned that it has about 90 per cent Al with Mg, Zn, and Cu as the major alloying constituent. Reynolds' new alloy R301, is a clad material, and information on the composition of both core and cladding have been released. Table I lists the core composition and physicals of the clad Alcoa and Reynolds alloys and of a typical German alloy, apparently unclad, in the fully heat treated condition.

For comparison purposes, the present high strength wrought aluminum alloy contains 4.5 Cu, 1.5 Mg, and 0.6 Mn. Corrosion resistance of 75S and R301 is claimed to be as good as the present alloys, and less sensitivity of the cladding to heat treatment is supposed to be found. Advantageously, there is a longer time interval between quenching and room temperature aging in which the material can be formed. Aging at elevated temperatures for periods up to 20 hr. is required for maximum properties.

German efforts in the low copper content aluminum alloy field are apparently motivated by a strategic lack of copper and a desire to get the better corrosion resistance associated with low copper content. Besides the 2 per cent Cu alloy mentioned they also report a copper-free alloy containing 4 to 6 Zn and 2 to 4 Mn, which is supposed to be a full substitute for copper-containing alloys.

Besides the postwar use of aluminum alloys in aircraft, they may be expected to compete with structural steel on an equal strength, which the high strength alloys can do without the impressive comparison made on a strength-weight basis. The new alloys and information gathered by the aircraft industry makes aluminum of potential value as a structural material for all types of transportation and even for buildings of the prefabricated type. Lightness is of minor advantage in fixed structures.

A great stock pile of secondary aluminum, accumulating at a rate of 60,000,000 lb. per month, is being built up. It is believed that this secondary metal will play a large part in the postwar automobile industry. L. W. Kempf of Alcoa, in a recent talk before the SAE, declared that in the past the price of secondary aluminum has been one-third to one-half that of primary, indicating that secondary aluminum will sell at about 5c. per lb. Compared with 1¾c. per lb. for iron, the metal cost for automobile castings in secondary aluminum ought to equal that for iron castings. Although general reverberatory melting of scrap is reasonably satisfactory, much of the scrap is so contaminated with iron or an excess of alloying elements that special purification means need be developed before it can be used effectively.

Magnesium alloys have found little application in the stressed parts of aircraft structures, but have been principally used for housings, panels, and other unstressed parts. Future improvements in magnesium technology may rectify this situation. Magnesium alloy aircraft wheels have been found to be satisfactory. Magnesium producers would like to see postwar automobile wheels made of magnesium alloys, estimating that in a 6,000,000 car year, the hundred pounds of magnesium wheels on each car would absorb the entire wartime capacity of 250,000 tons per year.

Considerable effort has been made to find new and better methods of refining the grain size of magnesium castings without resort to the cumbersome superheating treatments. No information has been released on the specific methods found. In an effort to improve the corrosion resistance of magnesium alloys, new surface treatments have been announced. Many of the treatments now employed use hot or cold acid chromate dips, which either remove considerable metal from the surface or take a long time of application. An improved chemical treatment is reported to be cold chromate-sulphate solutions containing ammonium anion and buffered at a slightly acid pH by acetic acid-sodium acetate additions. Reasonable protection is claimed in as little as 10 min. immersion. The pH is varied from 4 to 6 depending on the aluminum content of the alloy being treated. High aluminum contents require the more acid baths. To complete the chemical protection, chromate-treated magnesium is impregnated with oils or synthetic compounds, and baked to polymerize the impregnant. Actually, polymerize the impregnant.

TABLE I
New High Strength Wrought Aluminum Alloys

Composition	Alcoa 75S	Reynolds R301	German
Al	90	Bal.	Bal.
Cu	x	4.5	2
Zn	x	—	—
Mg	x	0.4	0.9
Mn	—	0.8	0.9
Si	—	1	1
Ultimate	77,000	69,000	60,000
Yield	67,000	61,000	51,200
Elongation	10	9	—

No large secondary market for secondary magnesium has been built up. Since there will be much secondary aluminum available, and the fabrication characteristics and casting of magnesium are poorer and more costly than aluminum, it is probable that magnesium will continue to find its principal market in the aircraft industry after the war.

Copper Technology

Cartridge brass continues to be the principal wrought copper alloy produced, and production of other copper alloys has decreased. The great number of proprietary compositions have been largely eliminated, and standard compositions adopted. In general, the impurity limits on nonferrous alloys have been relaxed. Most of the advances in copper metallurgy have been confined to improvements in melting and fabrication.

Recent units installed for melting and fabrication are larger and more efficient than those used formerly. Low frequency induction furnaces of up to 300 kw. capacity, capable of melting down as much as 2500 lb. per heat, have been installed. Rolling slabs are being cast chiefly in water cooled molds with copper linings, which greatly increases mold life and gives better casting surfaces.

Very little hot rolling of large ingots of cartridge brass was formerly done. Now, two high reversing mills of heavy construction, similar to those used in the steel industry, break down ingots 4 to 5 in. thick and weighing up to 2000 lb. each. Increasing use is made of rotary hearth furnaces for heating ingots for hot rolling. Cast bars of cartridge brass are commonly reduced to 0.450 in. in 11 passes and cold rolled to finish size. Some mills even hot roll the brass completely down to gage.

New high speed mills can cold roll heavy slabs of uniform width with the same flexibility as was formerly obtained by casting thinner individual slabs of various widths. In drawing rods, the tendency is toward heavier benches, permitting larger sections to be drawn, and in the manufacture of tubes, increasing use is made of hot piercing mills for alloys not so treated in the past, 70-30 brass, red brass, commercial bronze, and cupro nickel.

High velocity, forced convection heat treating furnaces, with their uniform and rapid heating characteristics, and induction heating for localized heat treatment are being used increasingly. In pickling, the use of continuously agitated baths, with jets for impinging the pickling solution on the metal, followed by wipers and brushes to minimize drag-out, has replaced the older methods of submerging rolls or continuous lengths of the metal in static baths.

Tin and Bronze

Production of electrolytic tin plate now amounts to about a fourth of the total, a factor which has helped greatly to reduce the amount of tin used in tin plate to only about 22,000 long tons a year. On the contrary, the demands for bronze and brass, particularly by the ship building industry, is currently taking around 35,000 long tons of secondary plus primary tin.

SOLDERING line for metal bellows. Each soldering stand has a fume exhaust adjacent to it. Photo courtesy Cook Electric Co.

Substitutes for tin bronzes have not found favor in ship building so far.

A comparatively recent development of considerable interest has been the casting of ductile high tin bronze, such as 90 copper:10 tin or 88 copper:10 tin-2 zinc which can be hot forged or extruded, as well as drastically cold worked. This depends on thorough oxidation and degassification of the melt, followed by deoxidation and casting to secure uni-directional cooling. It is not unusual to get consistently over 50,000 lb. per sq. in. tensile and 50 to 70 per cent elongation from such castings. Secondary bronze can be used, as well as virgin metals. Because of excellent corrosion resis-

(CONTINUED ON PAGE 180G)

The engineers bending over their drawing boards implement the war. A select handful of the more imaginative are hidden away to design the trains, automobiles, the planes, and the ships of the postwar world.

Transportation

Railways continue to bear up under an unprecedented traffic load. Meanwhile, development trends in transportation—land, sea, and air—indicate a distinct trend toward simplified propulsive systems for more economical operation in the postwar era.

By Jack R. Hight

THE American transport system is facing a transition period in its postwar years that is being thoroughly sampled during the years of wartime operation. While the railroads go on hauling the largest portion of the millions of tons of war materiel, innovations in the transport field are also gaining recognition and operating experience.

In contrast to the last war, when it became necessary for the government to take over the operation of the railroad system, the railways have shouldered the burden under their own management and produced praiseworthy results. Railroad men are facing the future, however, with some serious problems on their minds.

Discussion of the future of American transportation appears to hinge for the most part on one factor. Will the American economy pay the price for high speeds? In the answer to that question lies the ultimate answer to future design trends in all fields, new materials and new propulsive systems. To answer the question we can only make an historical approach. From the earliest days of man's civilization, there has always been an expanding market for the speediest method of transportation.

If this trend continues in the years after the war, important changes of emphasis and new "spheres of influence" for different modes of travel may be expected.

Railroad systems will develop freight facilities for greatly increased speeds. Rolling stock research was being carried on before the war to develop higher potential safe speeds for different types of equipment. Further work has been aimed at reduction of weight in car construction, to permit higher speeds with less power. Results are promising, and are as certain to pay dividends in increased business as in increased speed.

The whole subject of materials for equipment is being re-examined, and when economic factors give the go-ahead signal, light metals may enjoy wide application on freight equipment. The broad expansion of light-weight construction for the passenger trains is now foreseen by every railroad and carbuilder. In addition to their high speeds, however, the so-called "streamliners" have recalled the fact to many railroads that passenger travel can be profitable. Pressure growing in the future for higher railroad speeds and more economical operations will almost inevitably lead to the widespread use of gas turbines for power, with one railroad actually getting experimental results with a direct drive steam turbine. Brown-Boveri of Switzerland, had built successful gas turbine locomotives before the war, and their use in other fields has demonstrated an efficiency beyond possibility of doubt.

Although man has been flying airplanes for over 40 years, commercially for over 20, it has not been until this war that the airplane has emerged as an important mode of transport. The exigencies of war put a higher premium on speed than any peacetime economy can support.

The demands of war have pushed the aeronautical sciences so far forward, that air transport will become an important transportation system as soon as the equipment becomes available. There are admittedly many problems to solve and the development of well established lines, furnishing service wherever the market exists will take many years.

Certain transportation authorities assert that new modes of travel are important for the new business that they create, rather than for what they steal from established systems, and an important segment of the airlines passenger business will be newly created.

The influence of high speeds in the future is less well defined in the automotive field where historical emphasis on speed in equipment outstripped the development of highways suited to high speed travel. Early attention is apt to be given to the gradual expansion of safer roadways for automotive travel, allowing them to catch up with the cruising speeds of the average automobile. It would appear logical that when adequate roads are available, speeds of certain types of automotive equipment will also go up.

This adequacy of present car speeds for existing roads will place little immediate premium on the use of light-weight materials in new designs. Future needs may bring them into the picture if economic factors permit, particularly if the price of aluminum is appreciably reduced.

In America's reborn merchant marine economic phases of the speed and modernization questions predominate. It is approximately the same group of problems that killed the fleet of merchant ships built during the first World War that is haunting the future of our present huge fleet.

How can high prices be paid for seamen, materials and shipbuilding, and at the same time compete in ocean trade with the lower cost ships under foreign flags? The classic answer is by government subsidy. Next question: Will the American people support this type of subsidy? After the last war, the answer was "no." This time, on the promise that a powerful merchant fleet is vital to national defense, the subsidy will get strong support, and will probably be accepted as policy at least during the first postwar years.

Wartime billions spent on research

are promising new vistas in propulsive forces in the postwar future, although their development has been so shrouded in secrecy that evaluation is difficult. The year 1944 saw the official unveiling of the British developed turbothermal jet propulsion system for aircraft, the devastating German jet-propelled pilotless airplane, or V-1 robomb, the German true rocket type airplane, and the rocket bomb, the V-2, and the much less spectacular but possibly as important direct drive steam turbine locomotive in this country. Gas turbine research had already been carried on in Switzerland before the war, and their widespread application now seems assured.

The railroads have continued to bear the great share of the transportation load. Best available estimates for 1944 rail business, based on figures for the first 11 months indicate that the passenger volume will be over 96 billion passenger miles and the freight volume will be over 740 billion revenue ton-miles. These figures both represent new all-time highs, but the industry expects 1945 business to level off at this 1944 peak.

In contrast to the greatly expanded business being handled by the railroads, since the beginning of 1940 freight car ownership has increased by about 120,000 cars or 7 per cent and the ownership of locomotives by about 1 per cent. Business volume percentages approach 125 per cent increase for freight ton-miles and 325 per cent for passenger travel.

To handle the increased business despite low priorities for equipment the railroads have devised many new systems to achieve maximum utilization of equipment. Cars and trains are being loaded more heavily than ever before, trains are run closer together, cars and locomotives are run to marginal limits before overhaul, and other new measures have been taken. For example, the small diesel-electric locomotive has come into its own switching cars in yards, where it has almost completely displaced the steam locomotive. Some of the methods of handling the business are emergency expedients and will have to be modified at the end of the war, though the railroads will be able to get greater use from their equipment after the war.

The average equipment still in use, and the heavy usage given regular equipment by wartime business will result in a freight car demand of approximately 70,000 cars annually for five years, until the wartime back log is made up, and about 55,000 cars thereafter to handle a 1929 volume of business. This figure assumes that the roads will maintain a 20 per cent improvement in utilization. This compares with 30,832 cars built in the first ten months of 1944; 28,708 in 1943; 63,009 in 1941; and a total of between 40,000 and 50,000 estimated for next year. On Nov. 1, 1944, the Class I railroads had 30,408 freight cars on order, including 10,960 hoppers, 2625 gondolas, 229 flats, 12,750 plain box cars, 1438 automobile box cars, 2023 refrigerator, and 383 stock freight cars.

Prospects late in the year indicated that a projected Army car building program for 1945 would be partially cancelled, reducing the total from 26,000 cars to 4800 most of which are slated for delivery to India. This decision is said to be influenced by large stocks of new unused cars on hand in this country which the Army plans to put in service before building more cars.

Car orders in December 1944 totaled more than 10,000 units.

Much has been contributed toward the standardization of freight cars during the war period. Experiments which have been carried on by various roads indicate wide postwar use of lightweight cars, high-speed trucks, and roller bearings. Work with roller bearings, now in general use on locomotives and passenger cars is of particular interest. Experience is now available covering a period of several years, an example being ten 50-ton capacity cars placed in high speed merchandise service in 1939, and still in use.

The trend in freight car design, according to the Association of American Railroads, has long been toward increasing the ratio of capacity to weight by decreasing the dead weight of the vehicle. In the early days, freight cars would carry only about one-third their own weight. Now, the proportion is almost exactly reversed with the weight of the car itself being about one-fourth the total. In the years just before the war there was considerable progress in the redesigning of freight cars so as to reduce weight.

In recent years there has been a reduction of about 4000 lb. per car—accomplished through redesign alone. It is possible to accomplish perhaps another like reduction through the more extensive use of the light-weight metals. The question then becomes one of economic return on added cost—a question which can only be answered by working out the economics of specific situations.

Just before the war, the Association of American Railroads, with the cooperation of manufacturers, was conducting extensive tests looking toward the development of better freight car trucks. The results secured were inconclusive but undoubtedly the investigation will be continued and we may reasonably expect improvements in truck design in the future.

Locomotive production in the first ten months of 1944 totaled 783 units, of which 287 were steam powered and 496 were Diesels and electrics. This figure compares with totals of 773 in 1943, of which 429 were steam and 344 were Diesels and electrics, and 712 in 1942, when 308 were steam and 404 were Diesels and electrics. Present railroad plans for 1945 indicate that about 1000 locomotives of all types will be built during the next year. Beyond next year, estimated necessary replacement policies would call for about 1270 locomotives per postwar year until the war lag is made up, after which a normal retirement requirement of about 1050 units per year would have to be made to handle a 1929 volume of business.

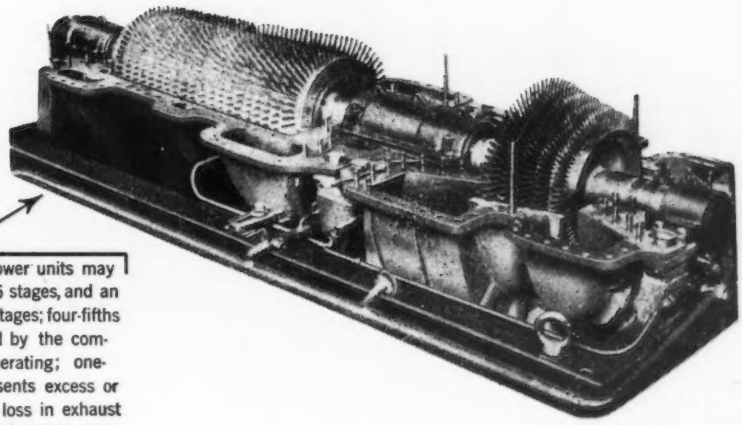
Locomotive research has progressed into many refinements of conventional propulsive units, as well as into certain new fields that promise much for the future of high speed rail travel.

Active Locomotive Research

Along "unconventional" lines the first steam turbine locomotive research project, in this country was completed in 1943, and the first direct drive steam turbine locomotive was completed late in 1944. The first mentioned engine was designed by Union Pacific, General Electric and Babcock & Wilcox with a steam boiler and steam turbine electric drive. After exhaustive tests by these railroads the high-pressure high-speed turbines were indicated to be entirely practical in locomotive service. It was finally determined that these units, because of the great amount of developmental and experimental equipment involved, were too difficult to operate and maintain in wartime. After proving the overall worth of the system, and indicating modifications for simplified operation, the locomotive was dismantled.

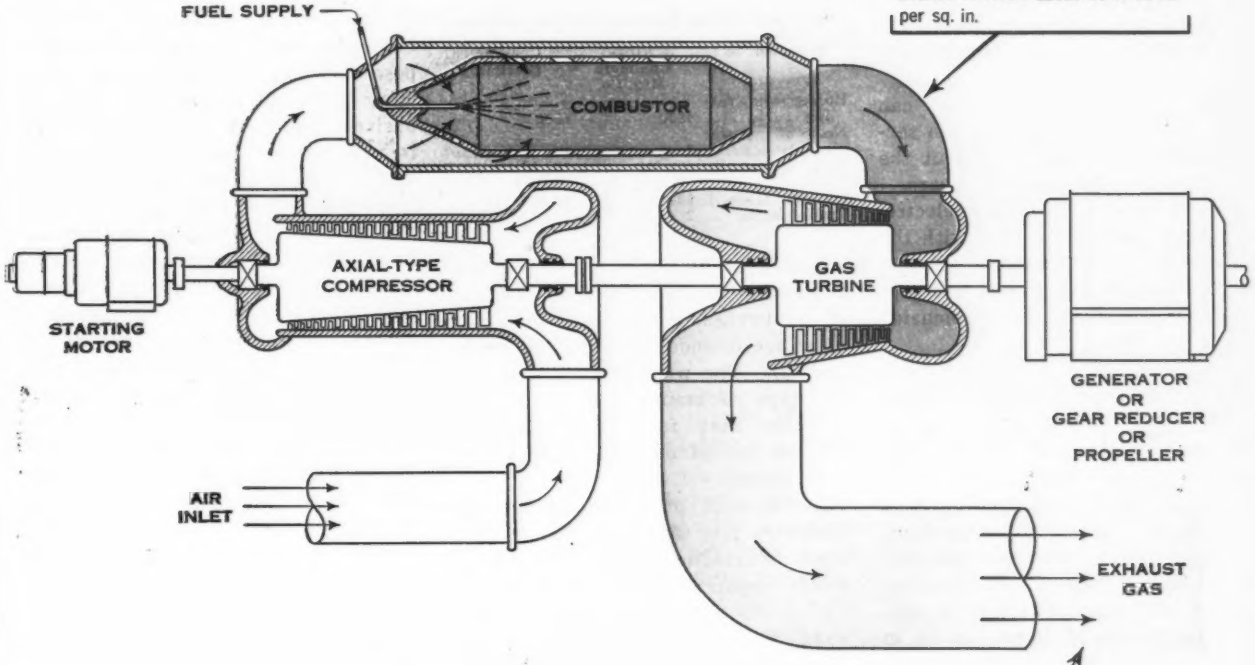
In November of 1944 the first direct drive steam turbine locomotive in this country was completed for the Pennsylvania. This experimental unit is now undergoing operational test work on that company's roads. The turbine unit for the locomotive was built by Westinghouse.

In the tenth year after their introduction into this country, high speed streamlined Diesel trains showed increasing strength. Outstanding among the Diesel units in use in this

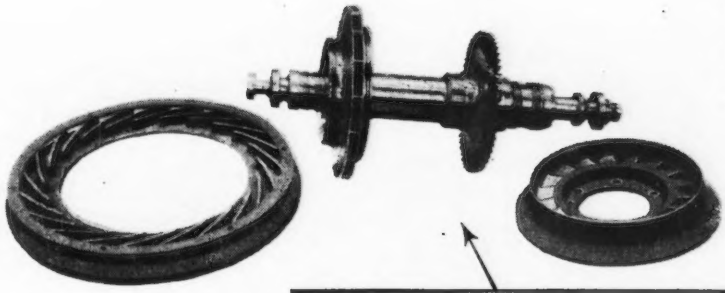


Mechanical or electrical power units may have, say, a gas turbine of 5 stages, and an axial air compressor of 20 stages; four-fifths of the turbine power is used by the compressor to keep the cycle operating; one-fifth of turbine power represents excess or net power available. Energy loss in exhaust gas is small, and may be reduced to practically zero by passing exhaust into a regenerator at outlet of the compressor; or system may be completely closed by exhausting into air inlet.

Air temperature about 1200 deg. F. for long-life multi-stage mechanical power units; about 1700 deg. F. for short life single or double-stage jet aircraft. Pressure about 40 to 50 lb. per sq. in.



Exhaust gas temperature 550 to 650 deg. F. at atmospheric pressure for long-life, multi-stage mechanical power units; temperature about 1200 to 1400 deg. F. and pressure 20 to 30 lb. per sq. in. for jet aircraft.



For jet aircraft, a single or double-stage impulse turbine operates a one or two-stage centrifugal blower to maintain thermal cycle. ALL NET POWER IS IN THE HOT, HIGH VELOCITY, HIGH PRESSURE EXHAUST GAS, WHICH IS THE REACTION JET.

country are the 4000 hp. two-cab units in use on the New Haven road for daytime passenger service and nighttime freight work. This road has in service and on order a total of 30 of these units, geared for a top speed of 80 miles per hr. This combination service utilizes the high availability of the units, with a consequent high in annual mileage.

According to a report to the A.S.-M.E. a fleet of fourteen 3600 and 4000 hp. passenger locomotives, operating on extended runs on the B&O between Washington and the cities of St. Louis, Chicago, and Detroit, has averaged approximately 18,000 miles per month per locomotive with maximum individual locomotive mileages of the order of 25,000 during the past several years.

The "standard" 2000-hp. passenger units now in service incorporate two 1000 hp. engines. Progress in current engine development programs indicates that these standards will be superseded in the near future by designs involving but one engine per cab.

Many of the 5400 hp. four cab freight units have been placed in service on various roads throughout the country during the past two years.

A new builder of Diesel-electric locomotives entered the field with the announcement by Fairbanks-Morse that it would offer units hitherto preempted by the Navy for submarine and surface craft.

The future of the Diesel-electric locomotive in road service, both for passenger and freight service, is intimately bound up with the development of lighter (higher horsepower per pound) engines, the use of which means lower-cost locomotive mechanical structures and lower overall initial locomotive prices. The critical situation with respect to fuel oil supplies, the continued improvement in steam-locomotive design, and the appearance "just over the horizon" of a new type of motive power, i.e., the gas-turbine locomotive, necessitate improvements in design and reduction in price of the Diesel-electric road locomotive if its gradual adoption by the railroads as a standard motive-power unit is not to be arrested. That the developments in supercharging, largely the result of intensive research and experience in supercharging engines for military use, will be available for commercial purposes after the war, there is no doubt; and the years immediately following the conclusion of the current strife will doubtless witness large strides in Diesel-locomotive development.

Interest in new types of motive power is shown by the continued study of the possibilities of the gas-turbine locomotive. Reference has been made in a previous report to a proposed design, and new designs have been studied during the year. Two proposals which have been described are compared briefly.

Proposed Gas-Turbine Locomotives

Proposed by:	Allis-Chalmers Mfg. Co.	General Electric Co.
Horsepower rating	4800	4500
No. of power plants	2	1
Total weight, lb.	450,000	360,000
Drive	Electric	Electric
Length, ft.-in.	90-0	75-4
Train-heating	2 separate boilers	1 waste heat boiler

Both designs can be lightened, according to their authors, by the use of lightweight materials. Both designs are intended to burn low-grade fuel oil. The widespread interest in this type of motive power makes it probable that further development will be intensified when war conditions permit.

In the field of railway passenger transport may be found one of the most heartening and enlightening trends apparent in the entire industry. It started in 1934 when the Edward G. Budd Co. christened the "Burlington Zephyr" in Philadelphia, and the Pullman Co. built its first streamliner. In addition to new high speeds, these new trains introduced luxurious fittings and reserved seating into coach travel, where it proved a boon.

Construction of light weight cars include aluminum and high tensile strength alloy steels in addition to the shotwelded stainless steel. There has been considerable competition among the proponents of these types of construction, with general agreement on one point only, that the old carbon steel coach is out, and will never be built again. The Budd Co. is definitely committed to the stainless construction, while the other car builders are prepared to build either high tensile alloy steel cars or aluminum according to the desires of the railroad.

Before the war placed a ban on passenger equipment construction about 125 streamline trains were built for all roads, a total of 2116 cars included.

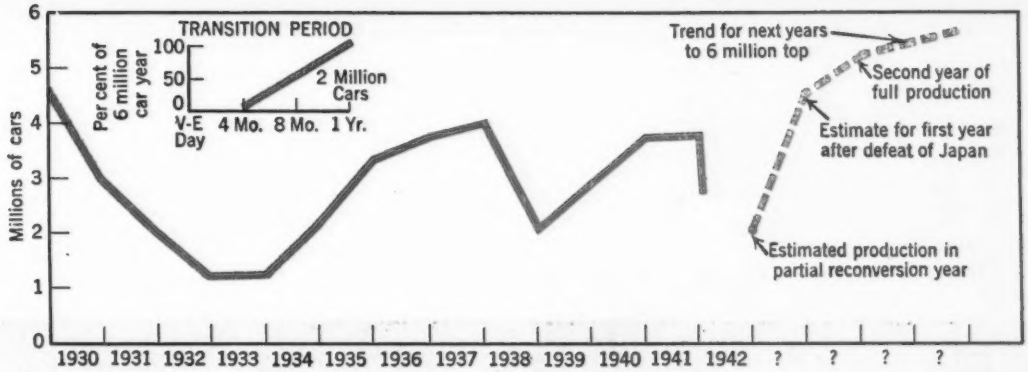
The government's decision in the anti-trust case against the Pullman Company, resulting in an order to dispose of either the sleeping car operating business or the car building business has posed a problem which is not yet completely settled. Pullman's decision to sell the sleeping car operating business was quickly made, but finding a customer is proving more difficult. It now appears inevitable that with certain exceptions a pool arrangement will be organized among the railroads to operate the 7150 Pullmans currently in use, possibly similar to the express service. Certain of the railroads, notably the Pennsylvania, have indicated that they prefer to own their own sleeping cars and will probably do so with arrangements to cooperate in the pool and use its cars in cases of unusual need.

Shells Rather Than Rails

The projected heavy domestic rail production for 1945 is giving way to the stepped up shell steel program. The original 1944 allocation for rails

MUGGS AND SKEETER
By WALLY BISHOP
WHAT! YOU HAVEN'T READ ABOUT OUR NEW AIR-PLANES WITHOUT PROPELLERS?
NOPE!
4-13
WHAT MAKES THEM FLY?
WELL, IT'S A LITTLE LIKE A ROCKETSHIP... ...IT'S LIKE... ER-R-R LET'S SEE....
...THE AIR GOES IN THE FRONT END... NO!.. THE AIR COMES IN THE BACK END....ER-R-R-...WAIT!!..... ....THE MOTOR DOES SOMETHING...
...FORGET IT!!...I DON'T THINK IT HAS BEEN INVENTED YET!!

AUTOMOBILE manufacturers envision production of passenger cars reaching 6,000,000 annually but not until three years after the defeat of Japan.



started at 550,000 tons per quarter, but was cut to 399,800 tons in the third quarter and 429,000 tons in the last quarter because of conflict with the shell steel program. This total of 1,928,000 compares with first quarter allocation of 507,000 tons of carbon steel for domestic rails, with a total production of 600,000 tons including export and military business. The roads asked for a total of 2,700,000 tons as their "must requirement" for the year, and are hopeful yet that increasing allotments for succeeding quarters may make up some of the deficit, to achieve a total of at least 2,400,000 net tons, by the end of the year. The chief difficulty here is that the rails will compete for ingots and rolling space with shell steel output, as long as ammunition is critical.

With all of the new developments in the rail systems, considerable interest is shown by rail men in the evolution of the American air transport system. It was in existence before the war, but actually grown up in the experience gained in delivering the extreme urgency materials of war. Since the first development of airplanes, men have been predicting a hazy "air age," and have succeeded in convincing themselves, decade after decade, that the next was to be one in which the sky would be blackened with airplanes.

First, it is now definitely established that aircraft will handle an important volume of passenger business in the postwar world. In preparation for this traffic airlines have since the beginning of the war been handling a maximum volume of both passengers on a priority basis and essential freight.

During the past year many of the airlines' planes have been sold back to them, so that from a low point of 179 airplanes in service in 1942, 315 were in use at the end of 1944. The commercial lines are thankful for whatever they can get, although in normal times they would probably find it uneconomical to operate the old Douglas DC-3's being "discarded" if other such airplanes as the Lockheed Constellation, the Douglas four engine Skymaster, designated the C-54 and the newer Boeing 377, commercial version of the B-29 Superfortress were on the market.

The operating airlines are doing as much planning for the future as can be done on paper, with hopes for widespread establishment of new lines, both domestic and globe encircling, and the purchase of new equipment as soon as possible.

Orders for transport planes have been placed with manufactures for delivery "as soon as war conditions permit," by most of the airlines. They include commitments for types now in production, and new designs not yet widely used.

Production of military planes levelled off during 1944, while the character of production changed considerably. Training planes continued to be cutback considerably, and emphasis was placed on the production of combat types, particularly the new heavy bombers, the B-29 Superfort, designed by Boeing, and the Consolidated B-32 Dominator. As had been done on earlier models, a production pool was formed for B-29 production, and lines were set up in three Boeing plants, one Martin plant and a Bell plant. One of the largest engine plants in the world is being operated by Dodge in Chicago to equip them, and Fisher's Cleveland plant is producing major components. This overall emphasis on larger planes and heavier types has resulted in a slight decline in the number of planes built per month, but an increase in weight of airplanes.

While the European War was proceeding far ahead of schedule, in late summer, the AAF made hasty provisions to reduce its procurement program, and drastically reduced many production schedules on specific types. This policy was reversed later in the year and standard types are still being produced on heavy schedules. The first two years saw designs of warplanes comparatively static, with major effort directed toward maximum production of existing types, while 1944 saw a host of new models succeeding the earlier planes.

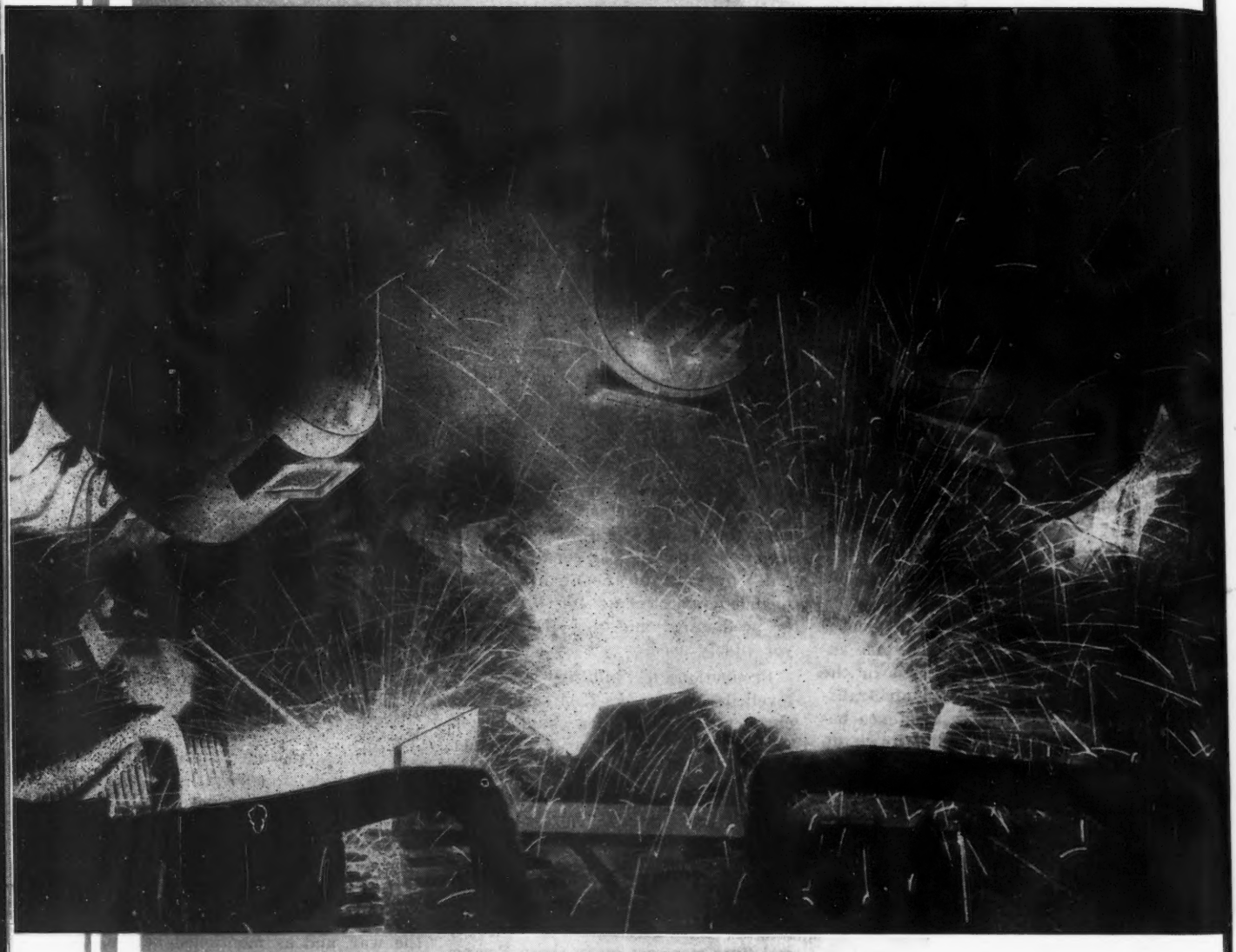
The first to be announced was the jet-propelled fighter, the P-59 A Airacomet, of which more will be said later. Also in the fighter field were the P-61 Northrop night fighter, and the Bell P-63 Kingcobra. The North American P-51, vastly improved since the prototype was built three years ago, came into its own in Europe. In the bomber field, the light Douglas A-20 was replaced by the A-26, and B-26 production was halted in the Nebraska Martin plant in favor of B-29's. The emergence of the B-29 and B-32 have already been discussed and the B-17 is being cutback in favor of the B-29.

Doubtless the most significant item in the entire transportation field during the year is the interest in the gas turbine for propulsion centered around the development of jet propulsion aircraft. The gas turbine was introduced in a locomotive in Switzerland built by Brown-Boveri, before the war, and as mentioned before, is considered by many to be an inevitable development in postwar rail propulsion, but it remained for Germany and Britain to apply the turbine power to aircraft.

Of the development in Germany, little is known other than that the Luftwaffe has used operationally squadrons of jet-propelled twin engine fighters designated the Me-262. It is described by AAF pilots as having limited range, but surpassing our "conventional" fighters in performance.

Announcement by Britain and the United States of experiments in the

(CONTINUED ON PAGE 180D)



To welders such as these at the U. S. Steel's Federal Shipyard goes the credit for building the largest merchant marine in history. Only by "sewing" ships together could the pace of global warfare be sustained.

Welding

Methods have been developed for welding the hardenable steels hitherto considered unweldable. Some answers have been found as to the behavior of metals under triaxial stress and metallurgical deterioration that takes place as a result of arc welding.

By Frank J. Oliver

PERHAPS the most significant developments that have taken place in welding in the past year that point to definite postwar possibilities have been in the welding of hardenable steels, both by arc and resistance processes, many of which had heretofore been considered unweldable. Because of wartime restrictions, much of the details are lacking at the present time, but it is possible to point to general trends.

When the shift was first made from riveted to welded combat tank construction, for instance, the high alloy stainless electrodes, like 25 Cr, 20 Ni, were widely used to produce an austenitic weld that had the ballistic properties the Army required. When alloying elements became scarce, manganese and molybdenum were substituted for a large part of the nickel and a lesser part of the chromium. Most armor welding today is done with this type of electrode, although a great deal of work has been done in developing a ferritic electrode, so-called to differentiate it from the austenitic electrodes for arc welding hardenable steels. Although probably not more than 1 per cent of armor is fabricated for this type of rod, its limited success points to great postwar possibilities owing to its much lower cost compared with even the manganese modified stainless steels.

Underbead cracking in the heat affected zone is the principal difficulty encountered in welding hardenable steels. Stainless electrodes overcome this, although the trend toward the use of steels of much lower alloy content to achieve the same physicals has aggravated the problem of dilution of the austenitic weld metal by base metal. Dilution may be such as to change the weld material from austenitic to ferritic and in many cases to what amounts to an air hardening steel. Dilution does not seem to be nearly as important a factor when a ferritic type of electrode is used.

In a paper on "Arc Welding of Alloy Steels," presented by Lt. S. A. Herres of Watertown Arsenal before the American Society of Metals (Trans. ASM 33, 535-563, 1944) the following factors were considered responsible for underbead cracking:

(1) Chemical composition of the steel.

(2) Processing of the steel prior to welding.

(3) Arc heat input.

(4) Weld cooling rate.

(5) Volume change during cooling.

(6) Ability of hardened area to relieve stresses.

(7) Restraint of weldment.

(8) Precipitation of dissolved hydrogen in the fusion zone.

As will be seen later, many of these factors are taken into account in the several attacks on the problem of rating the weldability of steel. In analyzing the development of a new high tensile ferritic electrode in a paper presented before the American Welding Society last October, D. C. Smith and W. G. Rinehart of Harnischfeger Corp. placed the chief blame for underbead cracking on item No. 8 and indicated that a coating composition was sought that would not precipitate hydrogen in the weldment. This requirement is met with an all-mineral coated electrode with a high carbon dioxide-hydrogen ratio, such as obtains in coatings used on austenitic (stainless) electrodes. According to this theory, coatings without organic materials are necessary. The most successful coatings used to date are calcium carbonate, calcium fluoride, magnesium silicates and ferro alloys with the usual binding agents, sodium and potassium silicates. The principal feature of these high strength electrodes, giving over 100,000 lb. per sq. in. tensile strength in the deposited metal, is that a relatively high manganese core wire is used and other alloying elements like molybdenum are introduced through the coating. Manganese is present in most coatings in varying amounts.

Early experiments in ferritic welding of armor were made with the submerged melt process, using high tensile wire and standard fluxes, also with fluxes originally developed for austenitic wire. Reasonably satisfactory results were obtained. Actually, however, this process never went into production, although at least two plants are making austenitic welds with the submerged melt process. A small percentage of manual welds are being made on armor with ferritic rods and enough data has been accumulated to indicate that the high tensile electrodes for fabricating high alloy steels postwar will be of this type. Considerable importance is attached to this inasmuch as there is a definite trend toward the use of higher strength materials for structural purposes not only on war goods but also on postwar products.

While practically all of the research programs sponsored by the National Defense Research Committee are on the restricted list, considerable work of an independent nature is reportable. Foremost among these studies is the work being done in an attempt to set up tests for predicting the weldability of steels or for indicating the conditions under which hardenable steels can be welded. The chief criticisms of some of the tests devised to date are that they are too complicated for the average welding engineer and require a laboratory

setup. Proponents for these tests indicate that they are simple enough if understood and that they give basic information about a material as contrasted with other tests which yield only specific information about the weldability of the material under a given set of conditions.

Initially, the general approach to the problem of the weldability of steel has been to set up a test that will give a clue to the loss of ductility that might be expected in the heat affected zone of the base metal. The war accelerated research programs indicate, however, that the real problem is the metallurgical deterioration of the base metal due to the heat of welding. Welding heat produces a bastard metallurgical structure ranging from the hardest martensitic phase to a fully spheroidized (annealed) structure. It has been found that the hardest section is not necessarily the most dangerous from the point of view of cracking and that failure may take place in the softest zone where ductility as ordinarily viewed is high but where the impact values may be extremely low. From this point of view, some of the weldability tests that have been proposed may be very misleading.

Notch Sensitivity Factor

In the future designers may not be so much interested in a steel with high elongation as one with a high resistance to triaxial stress, that is, one having a high impact value since the notched specimens used for impact tests subject the material to triaxial stress. A notched tensile specimen will give a similar indication. Fortunately, as regards the high tensile steels, the higher alloy content gives greater resistance to notch sensitivity. Fully killed steels give the best impact values and rimmed steels the worst. By the same token, steel mills are beginning to find that alloy plate as rolled has far too much segregation of alloy elements and that heat treatments designed to stabilize the structure will have to be used for the hardenable steels that are to be fabricated by welding.

Furthermore, it has been found that hardenability calculations based on the carbon equivalent of alloying elements are unreliable when boron intensified steels are encountered and frequently the fabricator does not know that the steel he buys has been intensified. Besides hardness has not been found to be a safe measure of the ductility of a steel since in the higher alloy grades much higher hardnesses can be obtained without undue loss of nominal ductility.

It was A. B. Kinzel of Union Carbide & Carbon Research Laboratories who first proposed that if the rate of cooling corresponding to any weld geometry, process and specific technique would be duplicated in a specimen of steel, tests on that specimen would be representative of the weld. In the so-called Lehigh[1] system which grew out of his suggestion, heat input and associated cooling rate in the welding of a steel is tied up with a ductility test through the common denominator of hardness corresponding to a position on a 1-in. Jominy end-quench test bar. Based on tabular data now available and the application of suitable "geometry" factors, it is possible to predict what welding conditions will produce a chosen ductility in any steel, of any plate thickness and joint design. When a new steel is encountered, actually it is only necessary to make a Jominy test for hardenability and a series of slow notch bend tests on synthetically heat treated specimens. It is reasonable to expect that in the sometime future, this kind of test data may be supplied by the steel mill. Steel is already being sold on the basis of a Jominy hardenability test. Simple as this end-quench test is, it is the type of test that a welding engineer might shy away from.

[1] *"Guide to Weldability of Steels," American Welding Society.*

Lehigh Data

What the Lehigh group has done is to relate a cooling rate (set up by any given set of welding conditions) with a position on any Jominy bar, say ½ in. from the end of the drastically quenched specimen. The Jominy hardness value of any new steel is then measured at this point or taken from the curve supplied by the steel mill. To translate this hardness into terms of ductility, further information regarding the relation of hardness and ductility is required. A number of flat specimens (1 x ¼ x 6 in.) are cooled at various rates from 2100 deg. F. by water, oil, air and furnace cooling. These specimens are then notched and given a slow bend test to determine the maximum bend angle before cracking occurs. Hardness corresponding to any bend angle is then correlated.

If a designer specifies a ductility represented by a 20 deg. minimum bend angle, for instance, the hardness corresponding to this value is determined by the slow bend notched specimen test and working back to through the Jominy test and the tabular data a variety of welding conditions may be selected. These conditions include arc current, voltage and speed of electrode travel, plus degree of preheat, if necessary. It is realized that welds cool faster in thick plate, with low arc current and voltage and with high speed of arc travel and with low initial temperature of the base metal. Usually the welding conditions determine the voltage and current to be used on any job and hence the welding speed may have to be varied to control the cooling rate within the range of ductility desired. The complete data take into account plate thickness and type of joint and indicate the amount of preheat necessary to make welds in order to maintain minimum ductility values.

This is not the kind of scientific approach that is intended for use by the job weldery. It should appeal more to fabricators of fully engineered products that have the necessary technical staff for mastering these involved procedures.

More Direct Approach

A more direct approach to the problem of weldability has been proposed by C. E. Jackson and G. G. Luther of the Naval Research Laboratory. In their beadweld, nick-bend test, a bead of weld metal is laid down on top of a 6 x 12 in. plate of given thickness (in actual practice, the thickest plate encountered in the design). Specimens 1½ in. wide are cut out of the plate and the weld bead nicked with a hacksaw to a point just short of the heat affected zone. With nicked bead down, the specimen is then given a slow bend until fracture occurs in the heat affected zone. The bend angle gives a measure of the effect of the welding heat upon the ductility of the metal which can be compared directly with similar data for untreated plates. The proponents of this scheme maintain that tests can be made under conditions closely simulating those encountered in practice with regard to steel composition, thickness of plate, brand of electrode and welding technique actually used. By the same token, others point out, this is not a test of weldability in general, but rather of weldability under a particular set of conditions.

It is now proposed that the beadweld, nick-bend tests be tied in with the principal of measuring heat input (volts x amperes x speed) into the weld used in the Lehigh tests but bypassing the Jominy test, which is only an intermediate step, anyway. Arguments in favor of this scheme are the use of welding to determine

weldability, elimination of the question of grain size as a factor and the fact that the test is simple and does not require special equipment nor a specially made Jominy test bar, not generally available when light plates are rolled.

Still another test, proposed by Leon C. Bibber of Carnegie Illinois Steel Corp., is a so-called T-weld bend energy test. It presents a method of measuring the maximum angle of bend of a plate section to which a plate has been attached at right angles with two fillet welds. Representing as it does a common type of welded joint, it is a practical sort of test but is not one from which generalizations can readily be drawn. It does give a ready answer to a specific problem involving given plate thicknesses and standard welding procedures.

Dr. Hess' group at Rensselaer has done work on the measurement of weldability also. While the approach is a theoretical one, it confirms in the main the results obtained from hundreds of actual welding tests made at Lehigh.

What does all this add up to? First, the fact that there are a number of ways of measuring weldability of steels now available, some of which will give answers to specific problems and others which will give a clue as to what is practical. On the one hand, the professors are trying to take every conceivable factor into account, including the influence of locked-up stresses on theoretical ductility, while on the other hand industry is looking for some simple test that will quickly tell what might be expected of a steel under general welding conditions. Those of a more practical turn of mind question whether a welding speed, once determined, can be held closely in practice without the closest kind of supervision and whether the operator really ever knows what volts and amperes he is using at any one time. Most of the modern machines are provided with dials for guidance in welding various materials but seldom with meters. It is true, also, that few companies other than those most closely interested in the program have actually applied these tests. Yet from the amount of related research activity going on it is apparent that as the demands of welding become more severe, the need for advance information on techniques will become more imperative. In the final analysis almost any steel is weldable, although preheating may be required, as well as special heat treatments at the mill. Up until recently, however, it has not been possible to discover the optimum welding conditions except by trial and error.

Obviously, there are other factors affecting weldability other than the cooling rate studies mentioned. The steel should be free from laminations and from hot shortness and should melt without undue sparking, spitting or violent gas evolution if it is to make a satisfactory weld.

Welding in Shipbuilding

Everyone agrees that fabrication by arc welding was what made our enormous wartime shipbuilding program possible. Welding has increased the speed of merchant shipbuilding for a number of reasons, an obvious one being the elimination of rivet hole preparation and the slower speed of riveting. The chief indirect reason is that welding has permitted the full utilization of mass production methods by the pre-assembling of all possible structure and using the shipway primarily as the final assembly point. By pre-assembly, many welds can be made at a high rate of speed in the down hand position, even by green operators with which most yards have to contend. As a result, despite the higher wage scales now prevailing, the cost today of a Liberty ship is $160 per deadweight ton as against $210 per ton during the last war.

At the same time, welding has brought its headaches to shipbuilding. Last fall a report released by the Maritime Commission on vessel failures for the period up to April 1, 1944, showed that out of 2993 large welded merchant vessels, fractures developed in 432 of them subsequent to launching. Fractures which were potentially serious occurred in 95, of which six resulted in the loss of the vessel. Such factors as shrinkage stresses built into the hulls by the welding process, the behavior of steel at low temperatures and the stress-strain characteristics inherent in the locally more rigid welded structures are among the principal causes assigned for such failures. Construction practices largely incidental to speed of production and structural design details are other factors that have contributed to fractures, the report stated.

Corrective Steps Taken

It is well known that low-carbon steels like ship plate have very low notch impact values at temperatures below 20 deg. F. The alloy steels are not nearly so critical. Hence one of the principal approaches to the problem is to avoid notch effects due either to design or faulty construction, like undercut welding beads. Hatch openings on new vessels are being rounded and "fashion plates" blended into the upper sheer strake to avoid points of stress concentration. In welded vessels, cracks once started, propagate rapidly through solid plate material and across welds, whereas, cracks do not progress across a riveted joint. Hence in reinforcing Liberty ships, a riveted seam has been provided at the gunwale, in the case of vessels in service by actually making a torch cut in the sheer strake just beneath the upper deck and riveting a strap on the outside. Other riveted seams are run on the deck plates on either side of the hatches.

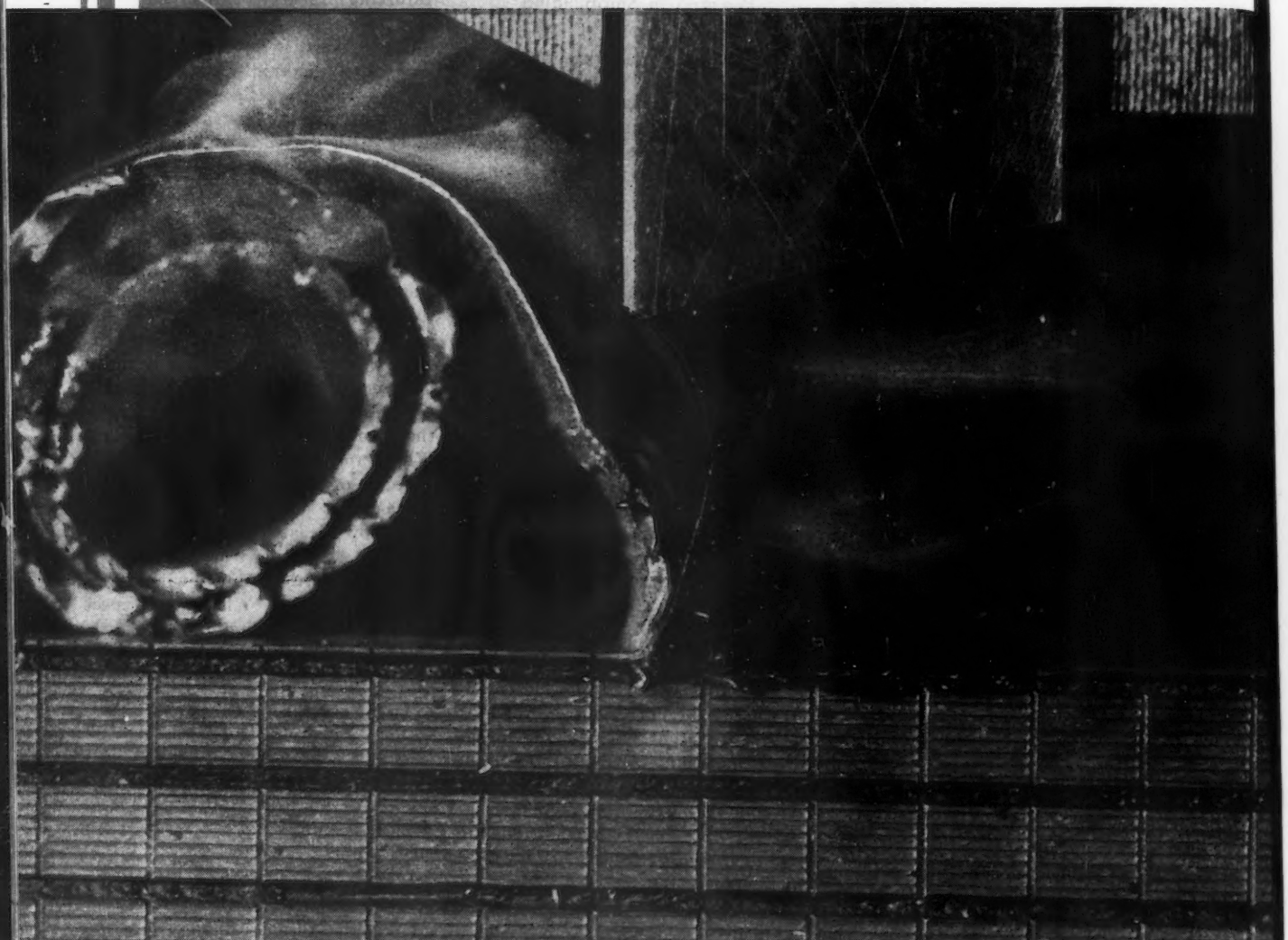
Shrinkage stresses can be reduced to a certain extent by proper welding sequences, working fore and aft from the center of the vessel. Recent tests have proved, however, what was generally conceded, namely, that even when there is no mechanical restraint between two plates, longitudinal stresses set up in butt welds are of the order of yield point stresses. When applied in a single direction stresses of this magnitude cause no concern but what the designer fears and knows least about is biaxial and triaxial stresses, which result in "square," brittle failures without apparent elongation. When a test specimen is pulled in simple tension, the piece shrinks laterally when stretched longitudinally (Poisson's ratio). Little has been known about what happens if the piece is prevented from shrinking laterally by opposing tension forces, but much data is being accumulated by the NDRC. This is often the condition when large structures are subjected to stress.

Full Size Tests

Carnegie Illinois Steel Corp. recently made some tests of this kind on full size sections simulating the T-connection between a deck plate and a side or shear strake. As reported by Leon C. Bibber,[2] a square type of fracture is practically always obtained from large welded joints pulled longitudinally, but the occurrence of such a fracture is not necessarily an indication of the absence of

(CONTINUED ON PAGE 174)

[2] *"A Study of the Tensile Properties of Heavy, Longitudinal Welded Plate Specimens Simulating Deck and Shell Joints," presented before the Society of Naval Architects and Marine Engineers, Nov. 16, 1944.*



Constant research is the pathway to better tools and machine tools. This ultra high speed photograph, 4000 frames per sec., shows a high speed tool working on stainless in the Allegheny-Ludlum laboratory.

Machine Tools

New demands for munitions plus Russian buying plus a rush for reconversion made machine tool orders take a second upturn at year's end. Reverses in Europe may end recent surge of unrated orders and discussions of surplus machine tool disposal problems.

By Frank J. Oliver

ESTIMATES of machine tool sales and production made by the War Production Board over a year ago fell far short of the 1944 mark, largely due to unexpected demands of war and too optimistic hopes for an early peace in Europe. A conservative estimate of a total volume of $325,000,000 worth of tools or roughly one-fourth the 1943 volume, was pushed up close to a respectable half billion by the year's end.

Month by month in 1943 the backlog of orders fell from a peak of over $1.1 billion to less than $200 million by December, 1943, and it appeared a year ago as if orders and shipments would level off somewhere around $30 million a month. The industry began to tighten its belt and with the encouragement of the WPB sought direct war contracts to keep its expanded facilities busy. Some builders carried this idea so far that they even bought additional equipment to balance production lines. While this policy enabled the machine tool plants to remain busy, to some extent, it stymied the industry in its efforts to absorb unforeseen demands on its regular products later in the year.

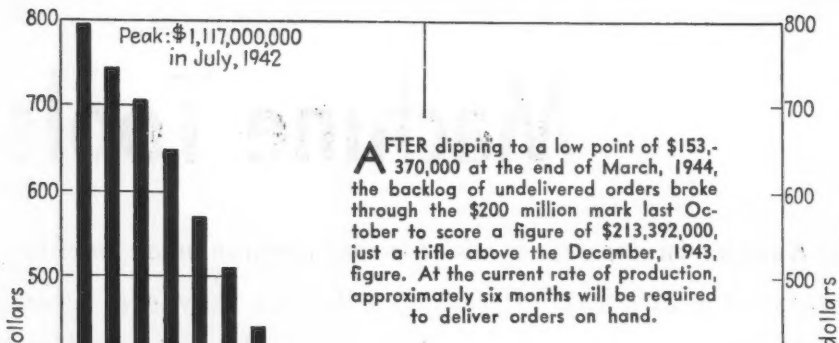
Twice during 1944 there was a sudden spurt in orders that caught the industry and the WPB off guard. The first, which occurred last spring, was caused by the decision of the Army to greatly enlarge the heavy munitions program, extension of heavy truck production, changes in aircraft and new landing craft. The munitions program is still keeping some key producers of shell turning equipment on the hot seat in meeting urgent schedules as final orders did not come through until August. The second kickup, which occurred in the fall, was due to a combination of factors: New types of munitions, mostly of the rocket and mortar shell variety, plus the Fourth Russian Protocol (Lend-Lease) plus a go-ahead signal from WPB lifting most restrictions on acceptance of unrated orders for peacetime reconversion.

Two years ago the impact of the Russian business would not have produced the splash in the market it did last fall. Its $120 million value represents one-quarter of the total volume of 1944 shipments and on the face of the situation it would appear as if it would absorb all of the 25 per cent of tools set aside by Order E-1-b for foreign and essential civilian needs, the other 75 per cent of capacity being allocated for direct and indirect Service orders. Actually the Russian business is spotty and is concentrated in the larger sizes of general purpose machine tools where the demand has fallen off most sharply, although there has been some buying of special purpose production machinery. Much of the Russian business was sought. "You asked for it," was the way one government official put it in addressing the machinery builders last fall. Nevertheless, this is official government business which will have to be accepted, although there is some griping behind the scenes to the extent that these rated orders are in competition with unrated orders from American firms for reconversion. It is fairly evident that this equipment is for rehabilitation of Russian industry. It is the only Lend-Lease business coming through at the present time, although there are plenty of inquiries out from other foreign governments.

The Fourth Russian Protocol calls for this country to deliver $120 million worth of machine tools by June 30, 1945. Inquiries by the Russian Purchasing Commission have greatly exceeded this figure and requisitions issued to manufacturers total a substantial portion of it. However, before production on these orders can be started, they must be approved by the FEA, must be scheduled by WPB and finally must be placed for purchase by the Treasury Department. About half of the orders were on the books by the year's end, indicating that the remainder will not get into production until this year. This means that an arrangement will probably have to be made to extend deliveries past July 1. To this extent some of the pressure of these orders on unrated domestic business will be relieved because of the spread over a longer delivery period.

Considerable criticism has been directed against the way the unexpected heavy munitions program was handled last spring and summer. There were months of delay in getting some of these orders on the books because the Army refused to set up pool orders which in the past had given machine tool builders a guaranteed demand such that they could safely proceed to order materials and otherwise increase their inventories of component parts in anticipation of firm orders. The experience has been such that there is every evidence that pool orders will be reinstated once more on future programs of this character.

Last spring industry spokesmen pleaded with the WPB to allow them to accept orders for machine tools essential for reconversion with the thought in mind that in the event of any sudden demand from the Army or Navy these unrated orders would form a cushion which could be sidetracked and even diverted to more immediate needs. In the meantime, the working force could be maintained within the limits imposed by the continued demands of Selective


Peak: $1,117,000,000 in July, 1942
AFTER dipping to a low point of $153,370,000 at the end of March, 1944, the backlog of undelivered orders broke through the $200 million mark last October to score a figure of $213,392,000, just a trifle above the December, 1943, figure. At the current rate of production, approximately six months will be required to deliver orders on hand.
MACHINE TOOL ORDER BACKLOG
Millions of dollars
800
700
600
500
400
300
200
100
0
1943
1944
*Estimated

Service. Many months passed before such action was taken, however.

Acceptance of direct war subcontracts by the industry on the other hand introduced a factor of inflexibility. Even when the demands of the new munitions programs pointed to the need for stepping up production of machine tools, the builders were reluctant to ask the WPB to relieve them of direct war work even though the tools division had indicated its desire to help out in this respect.

Munitions Load Spotty

Here again, the load was spotty and fortunately some of the plants most heavily loaded with direct war work did not make the type of equipment called for in the new munitions programs. A plant whose volume of machine tool shipments had fallen in November to 22 per cent of its 1943 peak monthly shipments, for instance, had 65 per cent of its current capacity assigned to Lend-Lease and unrated orders and only 35 per cent to the military, instead of the theoretical 75 per cent. While this case may not be typical, it gives an indication of how it is still possible for the industry to take care of urgent military demands, the Russian business and equipment needed for conversion to production of civilian goods. To this extent, overall statistics are often misleading.

In a sense, action last fall by the WPB in letting machine tool builders accept unrated orders was a negative one, but it did produce some immediate results. On the one hand WPB urged the industry to accept orders for machines to make postwar products but would not give any of these orders a rating. (The Russian Protocol orders carry an AA1 priority rating.) The only protection this domestic business can have is that an order for a given type and size of machine automatically becomes frozen into the schedule board 60 days before the promised delivery date, just as rated orders do. Only a directive can displace them after that time. Small wonder, then, what some buyers are taking a "wait and see" attitude on unrated orders they have placed.

The record shows, however, that the effect of this latest amendment of Order E-1-b was immediate and vigorous. Unrated orders for machine tools in October at $16,840,000 represented 30 per cent of the total sales volume of that month and accounted for 73 per cent of the gain of $23,370,000 in total orders over the September figure. Taking into account the fact that deliveries are again back to a six-month basis on the average, shipments of unrated orders are still picayune—in September a flyspeck $24,100 and in October, $421,000, a trifle better than 1 per cent of total shipments of $37,516,000 in that month. November shipments were $36,803,000. Lack of manpower and direct war contracts will prevent shipments rising much above $40,000,000 a month.

The situation now is comparable to what happened in the spring of 1942 when war contractors were told to place all their orders immediately if they expected any consideration that year. The biggest volume of orders ever recorded — $338,348,000 — was dumped in the laps of the machine tool industry that March, but subsequent shipments never came within more than a third of that figure, although backlogs shot up past the billion mark. By the same token, it is going to take some time under present conditions for the industry to digest the present volume of unrated orders in view of the circumstances previously outlined.

The biggest bulk of unrated orders is coming from the automotive industry. Being the largest employer of machine shop labor, the automobile companies have been very conscious of their social responsibility in mitigating the economic hardships which are bound to occur when the expected cutbacks in munitions and aircraft programs occur and the green light is given for the production of passenger cars. Obviously it is not going to be possible to make even a partial reconversion overnight, but the car builders would like to have all the essential machinery on hand when V-E Day arrives so as to keep the changeover period as short as possible. The situation varies from company to company.

GM Situation

The clearest picture of the present situation was given by B. D. Kunkle, vice-president of General Motors, speaking before the National Machine Tool Builders Association last Fall. He indicated that at the start of the war the corporation had sold or leased some 7700 machine tools out of a pool of 88,000 in order to help others get started when deliveries of new machines were at a premium. To replace these and to expand facilities in line with projected postwar markets for cars and trucks, GM ultimately will have to buy about 20,000 machine tools. Of this number, 2500 are considered critical and hence considerable pressure is being exerted to get deliveries on the bulk of them by early spring.

Although GM was among the first to anticipate the release of unrated orders and had its program lined up well in advance, it still has not been able to get definite commitments on roughly one-quarter of these critical tools. Since the time the WPB allowed unrated orders to be frozen into schedules after the 60-day deadline, the number of machines on which promises have been obtained

has risen by 50 per cent. A fair percentage were promised for December, but many more will go over into the summer. Deliveries on a few hot items like presses are likely to carry over into 1945. Army demand for 5-gal. "blitz" cans has recently placed a tremendous load on the manufacturers of small presses. Some large press builders are completely out of the market while their plants are converted to direct war work.

Other automobile companies are in the market for much lesser amounts of equipment, probably for the reason that they did not tear apart their facilities to the extent General Motors did. All these potential buyers will take over a certain amount of DPC equipment, largely of a general purpose nature that fits into the toolroom rather than the production lines. One company is known to be tooling up for a new and larger engine, but in general the machinery being ordered now is for fill-in purposes and to balance the lines. Radical shifts in machine setups, such as to fully automatic transfer type line production machines, will have to wait the second phase of the programs of retooling because of the present delivery situation.

At this stage of the game, the automobile companies would prefer to take their chances in getting new equipment than in taking possession of DPC equipment installed in their plants. For one thing, the Army and Navy have been reluctant to declare machine tools surplus if they happen to be idle for a few weeks, although it is possible under present disposal regulations for a company to buy a tool and continue it on its war job until such time as it is released. In any event, the Services have the power to commandeer any machine even though this power has seldom been used. Nevertheless, one Detroit manufacturer did buy some high production units from the DPC only to have the Navy put in a request for them within a short time. There was no argument here; the Navy had a job to do right now, the manufacturer was saving them for reconversion.

Surplus Disposal

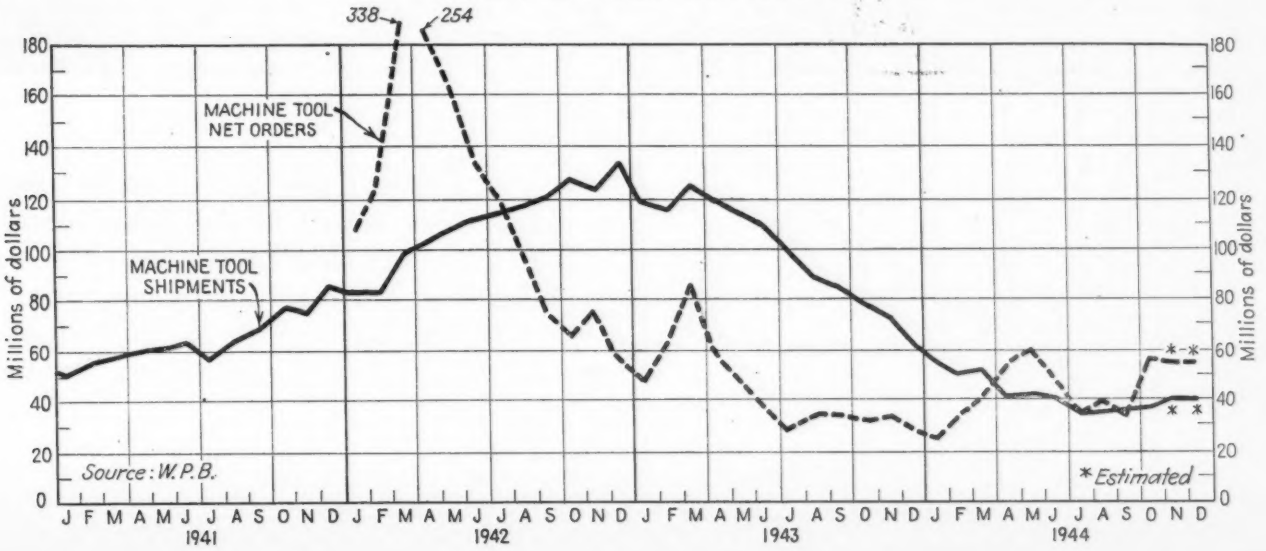
Disposal of surplus government owned machine tools took on more of an academic tinge at year's end as reports from the battlefronts began to put a heavy damper on hopes for an early peace in Europe, to be followed by cutbacks of 40 per cent in munitions programs. Nevertheless, the fact that by now the government holds title to some 600,000 machine tools is something that both government and the machine tool industry has been worrying about for some months, since this represents over 25 years' normal prewar production of the industry. The DPC owns about 300,000, the War Department 200,000 and the Navy and Maritime Commission together probably around 100,000. Some of this equipment is going to be held by government agencies.

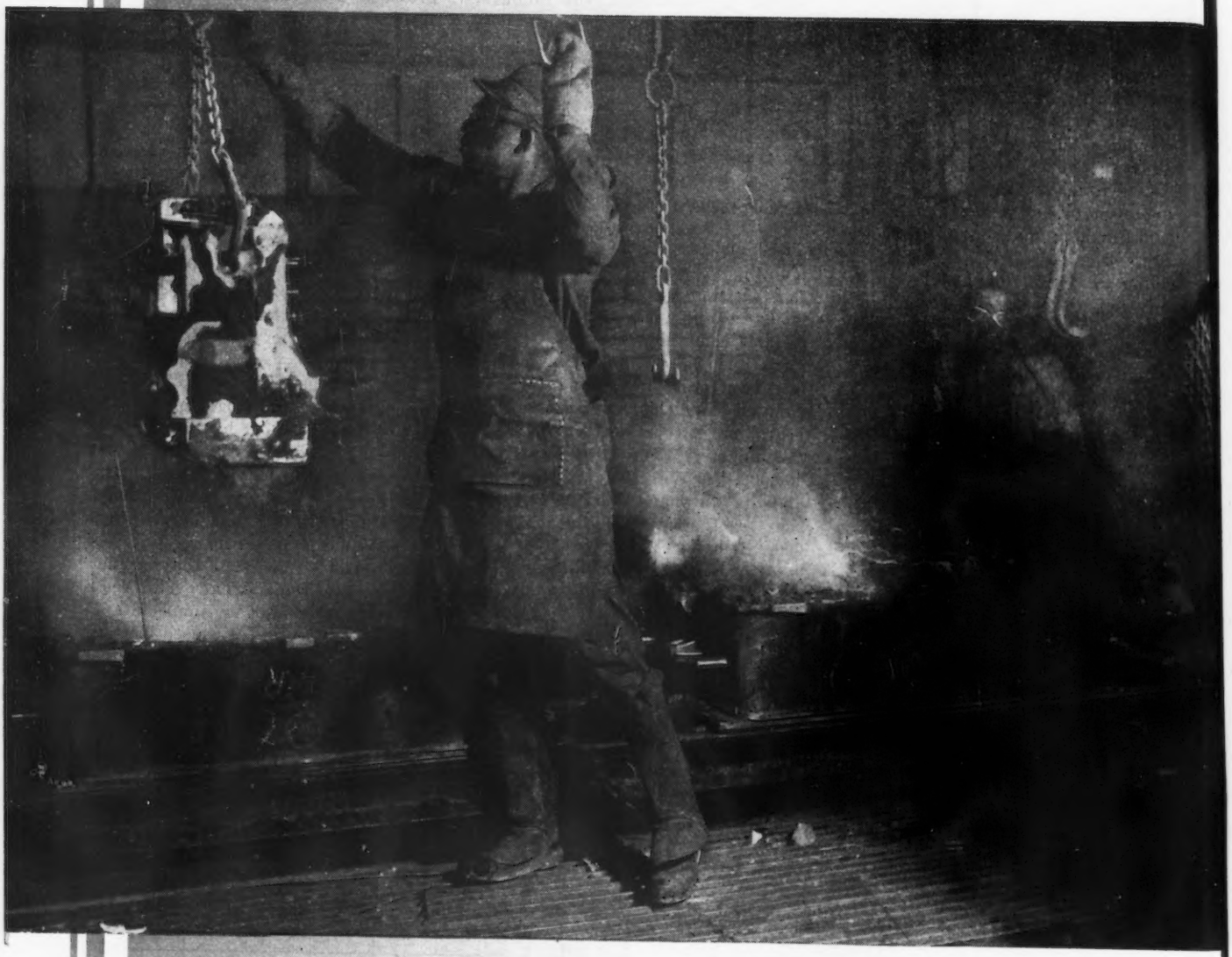
The arsenals and navy yards will undoubtedly retain the newest machines and what will be declared junkers will be the ancient machines and the second hand equipment the Army bought at the beginning of the war when its priorities were low. Much of this class of machinery has already been thrown out. After V-E Day government owned plants that are now privately operated may either be continued in operation or be held as stand-by plants until the war in the Pacific is finally over. Some plants will be retained as war reserve plants indefinitely. Both war reserve plants and stand-by plants may be turned over for civilian production provided there are no drastic structural changes made. It is expected that such plants will be readily convertible back to war work, however, though not necessarily on a 24-hr. basis. These plants will keep some otherwise surplus equipment off the market.

Relatively few machine tools have been declared surplus thus far, but a fair percentage of these have been sold. At the end of October, after disposing of about $12 million in the previous five months, the DPC had on hand $24,509,000 worth of metalworking machinery which had been declared surplus. The prices obtained average 75 per cent of the cost when new, a surprisingly high figure, partly accounted for by the fact that some pool order machines that had never been used were included in the list. These machines were sold under Regulation No. 3 issued by the original Surplus War Property Administration headed by W. L. Clayton, now in the State Department. This regulation provides for an immediate 15 per cent reduction for a used tool and a sliding scale of depreciation per month until the end of three years, at which time the tool is valued at 45

[CONTINUED ON PAGE 180H]

ORDERS for machine tools which had begun to stabilize around a monthly level of $30 million in the last half of 1943 went through a series of gyrations in 1944 as buying for reconversion was piled on top of unforeseen war orders and a big chunk of Russian purchases. Lack of manpower and the fact that the tool shops are loaded with direct war contracts will prevent shipments from rising to any great extent to meet the fresh demand.


338
254
MACHINE TOOL NET ORDERS
MACHINE TOOL SHIPMENTS
Millions of dollars
Source: W.P.B.
*Estimated
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1941
1942
1943
1944



To halt the loss of skilled men foundries are improving plant facilities and working conditions. Here a General Motors foundryman breaks out a casting with all the advantages of mechanization, safety, ventilation.

Foundry

Mechanization, physical plant improvement, and testing and process control are the means by which foundrymen expect to secure a quality postwar product in competition with other practices and, at the same time, offset the dwindling pool of workers.

By J. Albin

TO ascertain war and postwar trends in the foundry industry, THE IRON AGE addressed a series of questions to the foundrymen. The companies were first queried as to metal cast, whether gray iron, steel, malleable, or non-ferrous. They were then asked to specify foundry operations, whether jobbing or integrated (captive, or production). This was followed by nine questions covering such factors as plant improvement, Army and Navy standards, metallurgical supervision, sand control methods, postwar markets, manpower shortages, availability of materials, and, finally, significant developments during the past year in processes, metallurgy and equipment. The first eight questions permitted a Yes-No answer; the ninth invited comments.

The questionnaires were mailed to 1450 concerns. Over 385 responded, but the results here given are based on 365 completely answered questionnaires, representing approximately 25 per cent of the total number of questionnaires mailed.

What sort of foundries were selected in the first place to receive the questionnaire? The majority of foundries on the mailing list may be bracketed with the medium and large foundries in the country. Included are small foundries as well as those among the largest; in general, the list represents a cross-section of well-rated foundries.

Table I sets forth the accumulated totals to each of the questions. It may be noted that the combined Yes and No answers for most questions are greater than the original number of questionnaires counted, namely 350. A concern which turns out, for example gray iron and non-ferrous castings is regarded statistically as made up of two distinct foundries—a gray iron foundry and a non-ferrous foundry. About 16 per cent of the companies made more than one type of casting. Hence, their answers were repeated under each of the type castings made.

Table II contains a detailed breakdown by type of castings and by type of operation, that is, integrated or jobbing. About 8 per cent of the companies declared themselves as both integrated and jobbing. For statistical purposes these were divided equally between the two groups. In this respect, the number of foundries was not multiplied.

The important fact brought out by the answers to Question No. 1 is that the foundries as a whole believe that the equipment largely installed to meet war orders will continue to be suitable for postwar production. Necessity for purchase of new equipment, also by a large majority, is well epitomized by a company which made this comment on the returned questionnaire: "All equipment has received severe punishment and will require major repairs. However, new installations to meet increased production will only require normal maintenance."

Foundries by a ratio of two to one look forward to a continuance of Army and Navy standards. Some foundries qualified their answer by the statement that they would be willing to adhere to such standards provided that "the customers would be willing to pay." Another foundry, more positive in its viewpoint, wrote: "Quality requirements have meant better prices and we have found quality pays." That puts it succinctly enough to sound almost like a slogan.

Foundries, by a ratio of three to one are providing metallurgical equipment. This result has been expected since the acceptance of war orders has been tied up with such supervision. Foundries not having their own laboratory have utilized the services of outside testing facilities. The number of foundries answering affirmatively on the continuance of metallurgical supervision after the war clearly underlines their policy of providing a quality product.

The answer to the succeeding question on sand control methods appears to substantiate this viewpoint. The following quotation by a foundryman in Racine, Wis., expresses that viewpoint very well: "I believe that most foundries have raised their standards of foundry practice to give a higher quality of castings both from the metallurgical standpoint and precision. There are certain foundries of the non-captive type that have installed equipment, hired metallurgical help, installed laboratories, which will stand them in good stead for postwar work, in that it will give them a higher quality product."

The majority of captive foundries have answered the questions on postwar markets in the affirmative—a course to be expected, since they see postwar operations as necessarily established by the parent company. Jobbing foundries in the main are still engrossed with the requirements of their chief and often sole customer, the government.

Two interesting opinions on the postwar angle are here quoted: " . . . a more cooperative attitude on the part of the casting user to consider the foundry when designing castings and also to supply better pattern equipment." " . . . All authorities agree that the building program following the war will exceed anything previously experienced."

Although no specific question has been asked in the questionnaire about

physical plant improvement or mechanization, the number of comments that have been volunteered by foundrymen is noteworthy, particularly the tendency to connect the difficulty in attracting labor with certain discouraging features about foundry work. The manager of a large factory in the Philadelphia area stated that he considered the laying of a concrete floor in his plant, also the installation of windows, proper heating and ventilation as having contributed to increased production as much as the conveyor system and other items in a mechanization program. In the last two years he has been unable to hire a single molder. To cope with the necessity of employing unskilled labor, his company developed many refinements in the Randupson (concrete mold) process.

One foundryman wrote in connection with the question dealing with manpower shortages: "We must deal with this, but we are planning improvements to attract men." Another summarized the situation, saying that stress must be laid on the "improvement of working conditions to combat the bad name given to foundries." One foundryman had no further interest in the matter when he wrote: "Our foundry is shut down on account of laborers being unobtainable." A foundry more fortunate than the previous acclaimed: "We have found out how to appreciate a good laborer."

According to the poll on this question, five out of nine companies regarded the manpower shortage as an outstanding factor in practical postwar planning. As one foundryman stated: "Manpower is the answer to nearly all our problems both for the future and right now." An integrated type company expressed a more hopeful view: "We operated a training school to keep up our force. Have 15 per cent turnover but get enough replacements at the door."

Shortage of Manpower

Due to the severe shortage of manpower, the trend in foundries has been to mechanize most of the operations from the yard, where pig iron, scrap, coke, sand and other raw materials are received, through the melting, annealing and cleaning departments to the shipping floor. Mechanization makes possible the elimination of a hard, hot, backbreaking job—in keeping with the times to improve labor conditions in the foundry. A contributon in this direction has been the design and manufacture of complete mechanical charging systems, which reduce manpower to a minimum and entirely eliminate the hard physical labor generally associated with charging operations.

It has been proved that good housekeeping in foundries, as well as in other industrial plants, has a direct bearing upon efficiency and as far as future operations are concerned, the successful plants are likely to be those which mechanize and clean up their plants to provide the appropriate working conditions for their employees. The past year has seen wet dust suppression equipment in operation with much effectiveness in both steel and iron foundries. Latest development is a cupola spark suppressor which really does an excellent job of stopping cinders and fly ash and greatly reduces the amount of smoke emitted from cupola stacks. Outstanding features of electric furnace design helping to eliminate worker hazards are the automatic electric control of electrodes and the ability to position electrodes from the floor instead of having a man climb on top of a hot furnace with a sledge or wrench.

Mechanization Discussed

Pertinent to the subject of mechanization, one company wrote: "We have placed in operation many new machines to provide for faster and better molding. We now carefully watch and check our metal. Our operation is more to exacting specification than ever before, and we intend to continue improving machine molding." The following represents the stand of a malleable foundry: "The mechanization programs that have been carried out in the foundries have been the most important contribution made to the foundry industry during the war. These new facilities will allow for greater and lower cost production as well as better quality control." The substitution of gas powered trucks in place of wheelbarrows for moving sand, constituted for a particular foundry an outstanding step in its mechanization program. Apparently there are all degrees to mechanization.

The replies to the question on materials indicate that a problem is not felt to exist here except in the case of certain metals on the priority lists. The knowledge that large stockpiles have been accumulated, as in the case of aluminum, very likely caused most foundries to register a "No" answer.

One preventive method that has been set up in gray iron, steel, and malleable foundries to eliminate the cause of scrap and defective material has been the process control division or unit, usually organized as a part of the chemical and metallurgical engineering department of the foundry. The process control division consists of a number of selected men who are stationed in each department of the foundry on each shift. It is the duty of these men to see that manufacturing procedure and specifications are followed at all times along the lines of production. In addition they make all arrangements for sampling of raw materials, metals, molding sand, heat treated parts, etc., and see that these samples are submitted to the laboratories and the results properly evaluated.

The number of men required, their distribution in the foundry and their individual duties can only be determined by a study of each individual foundry. It is important for effectual control that these men be given authority needed to carry out their jobs to the extent of temporarily stopping production in any particular department of the foundry.

It has been pointed out that many of the frequently heard and no doubt justified complaints about unsatisfactory castings can be traced back to lack of close cooperation between the designing engineer and the foundrymen, resulting at times in designs which do not lend themselves to the manufacture of satisfactory castings. The elimination of unnecessary scrap caused generally by improperly controlled manufacturing methods and the alleviation of the shortcomings of the prevailing manpower situation has been definitely noted gains by foundries which inaugurated process control divisions.

To further the efficiency of process control men, several foundries have distributed sections of their testing laboratories to the locations in the foundry where their findings are of immediate importance.

In minds of foundrymen who have been queried on this phase of manufacture, process control has been extended to include the longer established sand testing laboratory and metallurgical laboratory.

The operations of a process control division is described in detail progress reported by the SAE War Engineering Board. Separate publications are available for gray iron, steel or malleable castings.

Precision Casting

The prominence given to precision casting in the questionnaire has been warranted by the replies. About one out of three companies considered precision casting as competitive to present foundry practice should large

castings (50 to 150 lb.) become practicable. Foundries in nearly the same ratio thought that jobbing foundries might adopt the techniques. However, a large majority did not definitely count on this process in their postwar production planning.

The president of a non-ferrous foundry of medium size in Baltimore stated that he considered precision casting somewhat in the nature of a specialty division for his postwar production. A small gray iron foundry voiced the opinion: "Job foundries will, in general, not use precision casting but should be familiar with and be in position to use in isolated cases." Another sees entry in this field: " . . . as necessary to secure and maintain profitable volume." In the opinion of one of the largest of jobbing foundries: "Some foundries may adopt the process, but hardly for large production."

Centrifugal Casting

The expansion of centrifugal casting methods has been considered by many foundries partaking in the survey as an outstanding development in casting methods. Gray iron foundries were largely in agreement on this point.

A few years ago, the centrifugal casting process was referred to as an economical method of casting metals which would be productive of a high quality product provided:

(1) Centrifugal casting equipment of the proper size, type and characteristics were available; (2) metal molds which would be easy to make and have a life sufficient to make production economical could be designed; (3) new sand molding techniques could be developed and good mold washes were available; (4) gating methods could be developed to produce high metal yields and perfect castings for irregular shapes as well as cylindrical castings, and finally (5) the amassing of useful information concerning pouring rates and spinning speeds.

The answers to the many problems involved in centrifugal casting have not been fully established. However, to date the process has come a long way and foundries have been able to produce economically a wide variety of centrifugal castings in production as well as on a jobbing basis. Research and development work on centrifugal casting has provided data on the many problems involved and has opened the designers' eyes to this new method of producing complicated shapes. Castings, which were not even thought of as potential centrifugal castings a few years ago, can now be readily produced by this method. Due to the stress of war conditions, centrifugal castings are being produced where forgings formerly held sway. Some of these applications of centrifugal castings have proven to be very economical, and will have sturdy roots for the postwar period.

Large quantities of bronze bearings for airplane engines are centrifugally cast and successfully pass X-ray inspection with a very low percentage of rejections. Heavy duty diesel engines use centrifugally cast bearings made in metal molds.

Iron Castings

The upheavals and activities created within industry by all-out-war production have been felt particularly in the fields of methods and materials. The results in the future are going to be particularly valuable to engineers, designers and production men who have a concentrated interest in the application of iron and steel castings. With regard to iron castings the new conceptions and applications might normally be considered as startling. Engineering thinking in the past has been accepting an attitude in relation to cast iron and cast steel which was proving more and more detrimental to the former from a design and production standpoint. This was brought about by the fact that most such thinking considered cast iron as a brittle and somewhat inferior material with some good properties but would reject it if the parts were to be exposed to heavy stresses, impact or high temperatures. Because of this the sudden demands of war production completely absorbed the capacities of existing steel foundries and forging shops. Furthermore, designers were inclined to deprive themselves of many benefits in the way of engineering properties available and limited to iron castings.

An unusual product development which in engineering thinking would rarely be considered a proper application for iron castings has been the design of a Meehanite casting used in soaking pit cover construction. The castings used consist of two long side beams, two short end beams and one center brace. Overall dimensions of the soaking pit cover are 13 x 18 ft. The built-up cover frame utilizing the Meehanite castings when completed weighed about one-half of the former cover built with steel castings. Ten complete covers were cast and eight have been in service for some time. Base plates upon which the furnaces are supported were cast in Meehanite. In spite of the severe service conditions imposed by the heat of the soaking pit, the covers have given no difficulty whatsoever.

During 1944, one company faced with extreme difficulty in securing tool steel thread gages decided to manufacture them at their own plant from Meehanite castings. Hundreds of these gages have been used and have been found to be completely satisfactory.

The gages are cast as a single unit; that is, the handle and gage are integral. In manufacture the rough castings are delivered to the machine shop where the centering of both ends and the rough turning and facing operations are performed on lathes. They are preheated to a temperature of 1200 deg. F., then transferred to a high speed furnace and brought up to a temperature of 1570 deg. F., after which they are quenched in cool oil, without any drawing operation. After this heat treatment the centers are lapped on a center lapping machine, and the gages are finish ground to the major thread diameter on a cylindrical grinder. Threads are rough and finish ground on a thread grinder which is completely automatic. Handles are rough ground and polished.

Malleable Castings

The biggest development of the past year in the malleable iron industry has been the expansion of the duplexing process for producing malleable castings. This process utilizes a cupola for melting the raw materials and refining and superheating the metal in pulverized coal-fired air furnaces.

The urgent need for malleable castings by the government's motor truck program, begun early last year, necessitated the building of several new malleable foundries and the enlargement of some others. Duplexing equipment, built under high priority, is already in operation in all of these new plants and turning out thousands of tons of high grade malleable for truck parts.

One of the outstanding developments in the heavy casting field of the malleable iron industry during the past year has been the introduction of the rectangular bell type radiant tube annealing covers, similar to those used in the annealing of sheet and strip steel. Heavy truck castings weighing from 60 lb. to 360 lb., such as a banjo and carrier housings, are loaded on a refractory base. A 23-ton cover which carries the radiant tubes and combustion equipment is

lowered over the white iron castings. The outer rim of the cover fits into a sand seal which maintains a gas tight seal. The castings are brought to temperature as rapidly as possible and produce their own atmosphere by the burning of the carbon from the surface, which is maintained within the proper proportion throughout the entire heat treating cycle.

Most of the large truck banjo housings malleablized at present are heat-treated in muffle ovens, which requires from 8 to 10 days. The handling of these heavy castings in and out of the ovens is slow and difficult. The radiant tube covers are much more accessible in this respect. At present a 65-hr. cycle is being used which will be reduced further to possibly as low as 50 hr. No containers are used for the malleablizing of the large castings. For medium and light section castings, it is necessary to load the castings in alloy baskets to permit the maximum tonnage to be heat treated.

The furnaces are fired with natural gas and the temperatures controlled automatically by recording controllers. One thermocouple is placed near the radiant tubes to prevent overheating of the alloy tubes, and two thermocouples are located on the outside and inside of the charge. Temperature differentials are within 10 deg. throughout the charge. The quality of malleable iron is on a par with that produced by any of the best furnaces in the industry.

Judging by the limited prewar activity, surprising strides have been made in the field of permanent mold casting on the score of production figures and with respect to complexity and weight of castings. According to the experience of a large fabricator, beginning as early as 1941 aluminum permanent mold castings began to replace sand castings very rapidly as a specification material. This continued through the war years and into 1944. Statistics released by the Aluminum and Magnesium Division of the WPB for the first seven months of the year compared with 1943 show that in 1943 the tonnage of permanent mold castings was 51 per cent of that for sand castings, while for the first seven months of 1944 it was 54 per cent of the sand cast tonnage. It is interesting to note in these figures that the heat-treated permanent mold castings were 67 per cent of the sand cast tonnage of 1943 and dropped to 62.3 per cent of the sand cast tonnage in 1944. However, the percentage of non-heat-treated castings increased from 15 to 22 per cent.

In the four years comprising the period immediately prior to the war and during the war, the art of making aluminum permanent mold castings and their acceptance and use as a production material has progressed as much as this industry accomplished in approximately the 25 years preceding that period. This, of course, will result in an entirely different postwar picture within the industry. One of the major prewar productive fields was aluminum pistons which during that period had one extremely serious setback in the latter half of the 1920's. Beginning early in the 1920's this industry made efforts to establish itself in other fields of production, but outside of vacuum cleaners, pots and pans, aluminum cylinder heads (for a limited period of time), washing machine parts and typewriter castings, this industry had a relatively limited high productive field for its products.

Since the production of aluminum permanent mold castings is one of the most highly skilled casting arts, the industry not only had to develop knowledge and experience but also had a very difficult promotional task in educating designing and production engineers to the limitations in the design of this type of casting, which was necessary if both quality and minimum cost of production by this process were to be realized.

Prewar production castings were made in weight ranges from fractions of an ounce up to not much over 18 or 20 lb. During the war, production castings have been made weighing from fractions of an ounce to more than 100 lb., although some heavier castings than this have been made by individual companies. With the great-

TABLE I

Questionnaire of Foundry Survey for 1944 *by The IRON AGE*

Questions	Answers—All Foundries			
1. Assuming your plant has been improved as a consequence of the war program,				
(a) Do you regard the new equipment as suitable for postwar production?	Yes	345	No	43
(b) Will it be necessary to purchase some new equipment?	Yes	292	No	106
2. Do you intend to maintain the degree of quality control now required by Army and Navy standards?	Yes	277	No	126
3. Metallurgical supervision,				
(a) Do you provide metallurgical supervision now?	Yes	322	No	113
(b) Will this be provided after the war?	Yes	319	No	92
4. Sand control methods are being widely extended,				
(a) Does your foundry have a sand laboratory?	Yes	221	No	215
(b) Use sand reclamation systems?	Core	108	Molding	178
5. Postwar Markets,				
(a) Have you ascertained the requirements of postwar customers?	Yes	223	No	159
(b) Have pattern drawings been made?	Yes	273	No	177
(c) Are the patterns being made?	Yes	147	No	202
6. Foundries have been seriously hit by manpower shortages,				
(a) Is manpower an outstanding factor causing a "wait-and-see" attitude on practical postwar planning?	Yes	235	No	168
7. Materials,				
(a) Is a similar attitude being entertained until government decisions on materials are manifest?	Yes	142	No	251
8. Precision Castings,				
(a) Does precision casting (lost wax method) fit into your thinking on postwar production?	Yes	65	No	340
(b) If larger precision castings (50 to 150 lb.) are made in the future, do you think they will be competitive to present foundry practice?	Yes	120	No	213
(c) Do you think that jobbing foundries will adopt these techniques?	Yes	95	No	209

Note—In question No. 9, the foundries were requested to state what they considered the most significant developments in (a) casting methods, (b) alloys or metallurgy and (c) general equipment. Answers to these questions are treated in various places in the text.

TABLE II

Detailed Analysis of Poll of Foundries According to Type of Casting and Type of Foundry Operation

	GREY IRON				STEEL				MALLEABLE				NON-FERROUS			
	Jobbing		Integrated		Jobbing		Integrated		Jobbing		Integrated		Jobbing		Integrated	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
1—Assuming your plant has been improved as a consequence of the war program.																
(a) Do you regard the new equipment as suitable for postwar production?	129	20	60	13	38	0	7	0	22	1	1	0	54	5	34	4
(b) Will it be necessary to purchase some new equipment?	108	48	63	17	28	0	5	2	16	6	2	1	42	19	29	13
2—Do you intend to maintain the degree of quality control now required by Army and Navy standards?	65	102	56	9	36	0	7	0	20	4	2	0	53	7	38	4
3—Metallurgical supervision,																
(a) Do you provide metallurgical supervision now?	115	58	65	23	38	0	6	1	24	1	3	0	39	22	33	8
(b) Will this be provided after the war?	107	41	63	18	36	0	7	0	22	1	3	0	44	17	37	5
4—Sand control methods are being widely extended,																
(a) Does your foundry have a sand laboratory?	74	96	42	43	33	5	6	1	18	7	3	0	23	40	21	23
(b) Use sand reclamation systems?	Core=32 Molding=65		Core=21 Molding=44		Core=14 Molding=27		Core= 6 Molding= 1		Core= 3 Molding=12		Core= 1 Molding= 0		Core=10 Molding=24		Core= 3 Molding=18	
5—Postwar Markets,																
(a) Have you ascertained the requirements of postwar customers?	64	60	58	22	22	15	3	4	12	9	2	0	35	35	27	4
(b) Have pattern drawings been made?	58	74	45	25	11	20	3	4	4	13	2	0	28	28	22	13
(c) Are the patterns being made?	43	89	44	24	7	26	1	5	10	11	0	1	25	32	21	13
6—Foundries have been seriously hit by manpower shortages, Is manpower an outstanding factor causing a "wait-and-see" attitude on practical postwar planning?	105	44	45	36	17	21	3	4	10	12	2	1	34	28	19	22
7—Materials, Is a similar attitude being entertained until government decisions on materials are manifest?	59	94	25	57	11	25	1	6	5	15		2	28	31	12	27
8—Precision Castings,																
(a) Does precision casting (lost wax method) fit into your thinking on postwar production?	17	137	14	64	8	30	1	4	2	21	0	3	14	48	9	32
(b) If larger precision castings (50 to 150 lb.) are made in the future, do you think they will be competitive to present foundry practice?	49	85	21	37	16	19	1	2	3	14	0	1	18	35	12	20
(c) Do you think that jobbing foundries will adopt these techniques?	36	87	20	36	11	20	2	1	1	15	0	1	17	27	9	22

er strengths of these castings, both in the as-cast and heat-treated condition, a very marked saving in cost results from the saving in the weight of metal when advantage is taken in design of the greater strength inherent in the process.

Previously, the greater tonnage of heat-treated aluminum permanent mold castings was made from high purity alloys. However, it had been so definitely established as the result of pioneering in the face of a shortage of high purity metal than many so-called impurities in high purity alloys were desirable alloying elements. A number of high productive castings still being made in 1943 from high purity alloys were converted, after proper tests, to metal derived from remelt sources—in some cases it became optional with the foundry to use either kind of metal. With this knowledge and experience in the hands of metallurgists and engineers, full use of the saving in cost of remelt alloys can be taken advantage of, which will result in a cost permitting adoption of aluminum castings desirable because of lightness and other factors, but previously prohibited because of cost.

Die Castings

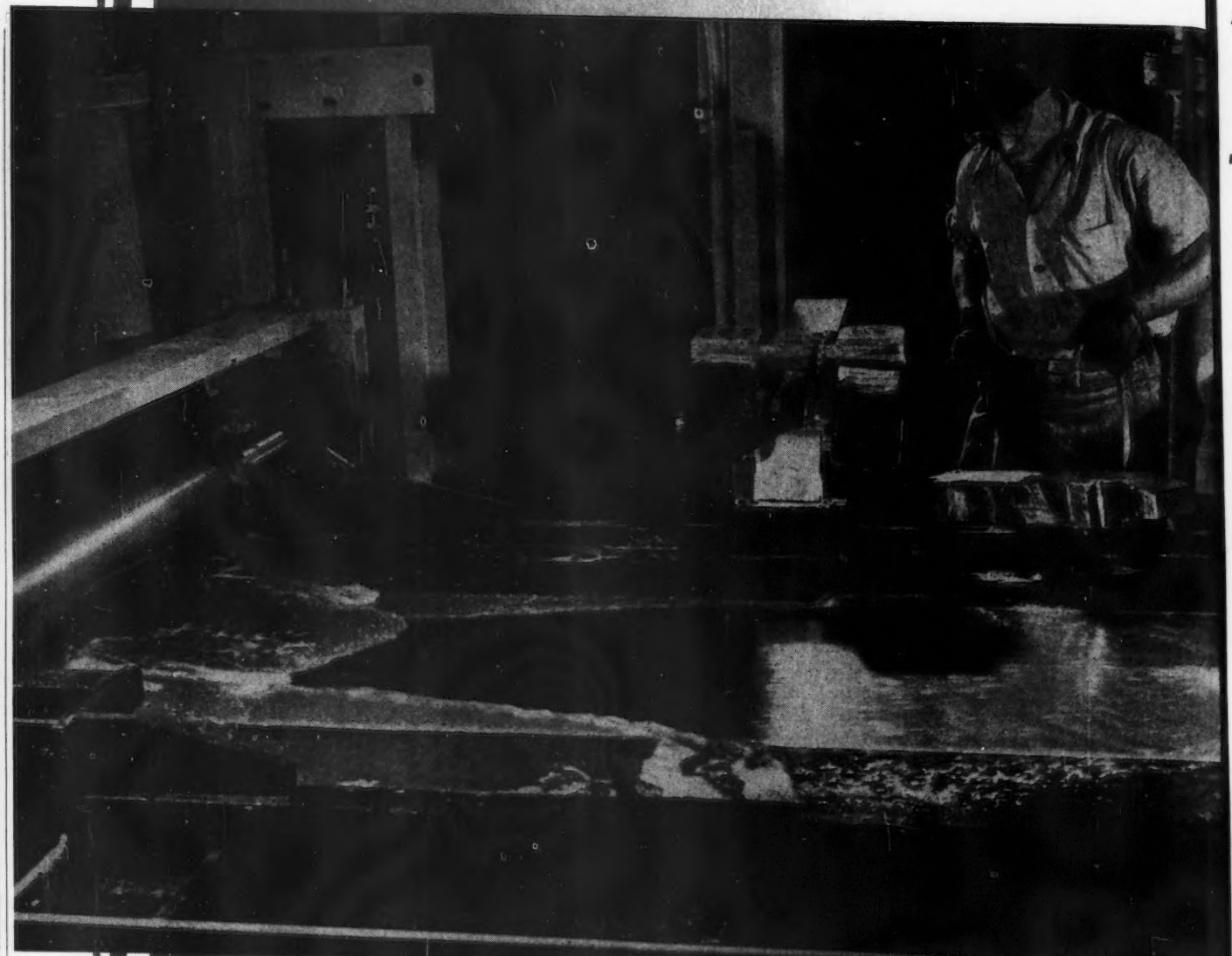
Price of metals and the die problem are basic elements to be considered in an analysis of the postwar possibilities of die casting according to the president of one of the largest die casting concerns. Prior to the outbreak of war, zinc die casting constituted more than 75 per cent of this country's die casting production. The remaining 25 per cent was almost entirely composed of aluminum die casting, with an insignificant amount of brass and magnesium die castings.

Since we are fighting a global war, one of the major requirements for metal parts is that they should not be affected by the extremes of temperature encounteerd in such places as the equator or the North Pole. Army and Navy officials have been hesitant to adopt zinc die castings for many purposes because of the fear that these varying temperatures may adversely affect the functioning of the metal parts.

The result has been that during the war, the relationship between the production of zinc and alumium die casting has been reversed, and aluminum die castings now constitute about 75 per cent of the country's die casting production. Magnesium and brass die castings have increased in use, and although many zinc die castings are used in war production, the percentage is a comparatively minor item.

There is no doubt that all industries will be largely affected in the postwar era by their experience during the war, and it may be interesting to speculate on what the die casting industry will be like when we return to the production of civilian goods.

There is no doubt that in the postwar period zinc base die castings will again resume their preeminent place in the die casting industry. It is true that larger volumes of aluminum, brass and magnesium die castings will be used, but the lower production costs and the greater accuracy of zinc base die castings will find a greater use in postwar than in the prewar era.



Only by electroplating was the available tin supply stretched to cover the war effort. Here are the plating cells of the first two decks of Republic's strip steel plating unit, showing vertical bus bars connected to anodes.

Metal Finishing

Metal finishing has played an unprecedented role in this war, and most of the progress made has been along the lines of replacement and substitutes for scarce or critical materials. The industry is more than pleased with the very excellent postwar prospects.

By Adolph Bregman

THE direct impact of the war brought about great changes in electroplating. Countless plated articles normally used by civilians were eliminated or drastically curtailed. Also, as never before, there has been a large scale application of plated finishes to implements and articles of war. By and large these two changes have compensated for each other, so that the total areas now plated are perhaps equal to those in peacetime, even though the metals used in the coatings are not applied in the same proportions or for the same purposes as formerly.

Plating has played an important part in war production in three ways:

(1) Steel has replaced nonferrous metals because of their scarcity, and has had to be protected against corrosion.

(2) Plating has been used to prevent acceleration of corrosion by dissimilar metals.

(3) By plating, specific required properties were obtained at the surface.

The scarcity of some metals has curtailed their use in plating, but by the same token, the scarcity of nonferrous metals has called for the use of plating to protect the steel substituted for the scarce nonferrous metals.

The metals now most used for plated coatings are cadmium, zinc, lead and tin for protection against corrosion and chromium and silver (with lead and iridium) for resistance to wear. Silver and gold are deposited on radio parts in which a highly conductive surface is needed for high frequency currents. Silver plate is used on copper bus bars to reduce resistance at the contacts. Nickel plating is permitted only for those few purposes where it is irreplaceable. Rhodium plating is specified for high reflectivity and tarnish resistance. Copper and copper alloy plating are much more liberally permitted, but still subject to a long list of restrictions.

The most critical coating metals are cadmium, nickel and tin, being classified by WPB as "insufficient." Zinc is now quite free for essential and even many civilian uses, being substituted in many instances for cadmium. In general it furnishes at least as good protection for steel against corrosion, but the bulky white corrosion products are more easily formed on it than on cadmium. However, various chromate films retard this corrosion and make its use possible for many purposes. Examples of such chromate films are Cronak, Iridite and Anozinc. Iridite gives an opaque olive drab coating, which will be smooth and shiny over a bright highly polished plate on a steel base, and matte over a dull plate. Impurities in the metallic bring about variations in the nature or color of the coating after the dip.

Two types of Anozinc, a yellow and a black are available. The yellow coating appears to be largely zinc oxide and zinc chromate with some soluble chromates absorbed from the solution. The black coating is similar except that in addition, it also contains basic chromic chromate.

Cronak is an irridescent appearing finish on zinc which retards the formation of white corrosion products, especially in salt atmospheres. Many valuable suggestions on the substitution of zinc for cadmium are contained in two publications of the Operating Committee on Aircraft Materials Conservation, Conservation Directive 2B and Conservation Bulletin No. 6A.

It should also be noted that the baked phenol formaldehyde varnishes also furnish good protection against corrosion of steel, but the steel must not be exposed through pores or scratches, as at such points the steel will corrode.

Study of lead coatings, both hot-dipped and electroplated, was promoted by the former scarcity of zinc. Lead coatings do not completely protect steel that is exposed in pores or scratches, but if the coatings are reasonably heavy, according to ASTM tests, the corrosion of the steel does not penetrate deeply. The flaws are apparently sealed by the products of corrosion.

Initially there was, understandably enough, confusion and contradiction among government specifications and requirements for government agencies. But general specifications were developed rapidly and there is now a concerted effort to have them used by all interested agencies. An example is U. S. Army Spec. No. 57-0-2C, adopted Dec. 11, 1943, covering Finishes, Protective, for Iron and Steel Parts, and including electroplated coatings of zinc, cadmium, nickel, chromium and lead; phosphate coatings and oxide black coatings. Other important specifications are AN-P-32 Army-Navy Aeronautical Specification, Plating, Zinc; and AN-QQ-P-421A, Army-Navy Aeronautical Specification, Plating, Cadmium.

In all specifications, thickness of coating is the most general requirement and specifications commonly state minimum thickness on significant surfaces although average thickness is occasionally defined.

The contributions of electroplating to the war effort were evidenced in many ways besides the direct application of a coating. One leading example is the providing of equipment for degaussing or anti-mine protection. The need for such measures was crit-

ical for all ships afloat early in the war. Low voltage, high amperage generator sets were required, so plating generator manufacturers put at the disposal of the Navy Department their long experience with such sets. By 1943 there had been installed on a substantial number of the Navy's most important fighting ships, a number of compact high speed units. Then the Navy set up an emergency program to provide similar equipment for almost every type of service ship: oilers, troop transports, ammunition ships, stores cargo vessels, seaplane tenders, destroyer tenders, stores ships, hospital ships and submarine tenders. Later an even more compact set was developed for use on battleships, heavy and light cruisers, aircraft carriers and carrier escort vessels, tenders and repair ships.

Another contribution was the development of full automatic plating machinery for the production of Naval torpedo parts. Complete plants for chromium, cadmium, nickel, tin and copper finishing of torpedo parts are in operation at various Naval Ordnance plants and Naval Torpedo Stations.

Full automatic cadmium plating machines for the processing of steel airplane propeller hubs and adjustable pitch parts are also in continuous operation at a large airplane propeller plant. This installation represents the successful solution of a neat problem, namely, to combine the handling in a single unit, of a wide variety of parts which sharply varied in surface area and which had to be plated to rigid Navy specifications. Cadmium plating in a complex operation involving precision machining has also been applied on wet gun mounts for submarines.

Anodizing of Army and Navy aircraft production of aluminum and magnesium parts has become an operation of the utmost importance in the war industries. In aircraft production further electroplating operations of primary importance are: chromic acid anodizing of pontoon floats; chromic acid anodizing and special cleaning of airplane cowlings and special ammunition chutes; chromic acid anodizing of parts for amphibian planes; chrome plating rings for aircraft engines.

Certain bearings for aircraft motors require deposits of lead and indium, which involve rigid control by the use of delicate measuring instruments. Full automatic machinery was perfected for this purpose and is in operation at a large aircraft motor plant. The conveyor arms of this equipment carry the measuring instruments throughout the processing cycle.

Cladding steel with nickel and copper for ammunition was another contribution of the electroplating industry. One electroplating equipment maker designed and built such equipment for a leading steel mill, receiving the plating specifications and then developing methods whereby the current density of the nickel plating was increased from an original 10 amp. per sq. ft. of work surface to 150 amp. with almost proportional increase in production.

One manufacturer of electroplating equipment, in spite of the fact that the company was without previous experience in such manufacture, has designed and is producing multiple welders for the shipyards.

Technical Developments

Anodizing and Corrosion Prevention. Darren and Tubbs showed that very satisfactory black dyed oxide coatings could be produced on aluminum which had been anodized in the regular chromic acid baths. Colored finishes are also readily obtained on chromic acid anodized aluminum and its alloys, in very much the same manner as black finishes. The procedure may be modified to produce almost any desired color.

Polishing for appearance's sake was necessarily eliminated in the last two years, but deburring was found important in the efficient production of war implements, and polishing and finishing room equipment was applied to this purpose.

The Bullard-Dunn process of electrolytic descaling is being used very successfully for cleaning rubber molds between molding operations.

During the molding of rubber products a mold is usually first swabbed with a lubricant, the rubber is put in place and then heat and pressure are applied. After several service runs the mold becomes "caked up" with burned-on rubber and residues resulting from the effect of the heat or lubricant employed.

Many methods have heretofore been used to clean molds, soaking in alkali, hand scraping, torch burning, sand blasting and combinations of these treatments. All of them are slow and none of them completely effective. Recessed areas, which are common to most molds have been particularly difficult to reach by these methods. Moreover, their abrasive action wears out the molds.

Electrolytic descaling by the Bullard-Dunn process results in more thorough cleaning than previous methods. It saves time and labor and it prolongs the life of the mold because it does not attack the basis metal.

Restrictions in the use of various surfacing metals recently caused considerable interest in electrodeposition of iron as a substitute metal. Investigations on iron electrodeposition, described in a paper by Schaffert and Gonser of the Battelle Memorial Institute, were prompted by restrictions on the uses of copper and nickel in the electrotyping and stereotyping industry.

The greater part of the work was confined to the development of an iron plating bath and methods adaptable to electrotyping and surfacing of stereotypes. A combination sulfate-chloride bath was developed and tried out on a commercial scale in several electrotype foundries with considerable success. Later, a more thorough study of the properties and behavior of this sulfate-chloride bath was made in order to determine other possible applications.

Much interest was evidenced in the process of depositing metallic coatings on plastics, described in a paper by Harold Narcus of the Plating Processes Corp., Holyoke, Mass.

Metallizing Plastic Materials

Five principal methods are available for metallization of plastic materials, each presenting certain advantages and certain limitations. The methods are as follows:

(1) The varnish-conducting powder method, such as the use of wax-graphite or plumbago combinations, or lacquer-copper powder, or the shellac-silver sulphide method.
(2) Metal spraying method
(3) Cathode sputtering
(4) Metal evaporation
(5) Chemical reaction

These newly developed techniques have resulted in the opening of large new fields in electronics and electricity. The plated plastics are used to replace light metals in radio and shielding devices in aircraft. Resulting reduction in weight permits the use of larger diameter tubes or rods in the element for the frequency modulation and television antennae. Surface area is thereby increased and pick-up performance materially improved.

Some of the other applications for deposits of metals on various nonconducting surfaces are: gas and liquid proofing containers; electrical fuses, contacts, high tension devices, condensers, etc.; industrial cams, instruments, machine parts, reflectors,

rollers; mirrors and molds for electroforming and electrotyping; novelty and costume jewelry pieces of infinite number and variety; radio parts—loop antennae, cabinets, coils, dials, grills and knobs; airplane parts, dashboard parts, escutcheon plates, etc.

Du Pont announces the commercial manufacture of a series of new conductive coatings containing silver powder, which, when applied to a variety of non-conductive materials, produce a surface of low electrical resistance and high conductivity. Among the base materials to which the coatings may be applied are: glass, porcelain, steatite, plastics, wood, cloth, paper and leather.

The coatings are a dull metallic gray. They can be applied by spraying, dipping or brushing, followed by air drying. In some cases low temperature baking is necessary.

There are a number of coatings available, with varying characteristics, formulated to meet varying characteristics in the material to be coated and degrees of adherence and film toughness. Four products are available in commercial production. Some half dozen others are available as laboratory samples. Also a thermoplastic conductive cement is available.

T. G. Coyle of United Chromium, Inc., Waterbury, Conn., was awarded the first prize for the best paper read at the 1944 convention meeting of the AES. Its title was "Porous Chromium Plating, Its Principles, Procedures and Operating Practices" and it presented a detailed treatment of the matter covered in the title.

Porous chromium plate has many possible applications. At present it is used extensively on rolls, piston rings, Diesel engine cylinder liners and aircraft cylinders. It may be produced in a number of ways which in general, involve three principal control factors.

(1) The deposition of the plate
(2) The etching treatment
(3) The finishing process

The plating operation is much the same as that in regular hard chromium plating practice where plating to size is required, but specially close coordination and control of bath composition, temperature and current density are required.

The etching may be accomplished by electrical or electrochemical treatment, or it may be achieved by mechanical means. It is carried out on the plate itself or on the basis metal, or on both. Finishing is done generally by polishing, lapping or honing.

The porosity of the plate is determined by the amount of plate removed and the rate of removal in the etching and finishing processes. Hones and inspection devices are the only special equipment needed.

Hard or industrial chromium plating continued to be an important factor in the production of tools for the war effort. Hardness, low coefficient of expansion and resistance to abrasion or wear are the three outstanding characteristics of hard chromium. From these properties result the three main applications of hard chromium plate, namely: plating on tools for longer life and better finish of parts; plating on cutting tools for their longer life; plating for build-up.

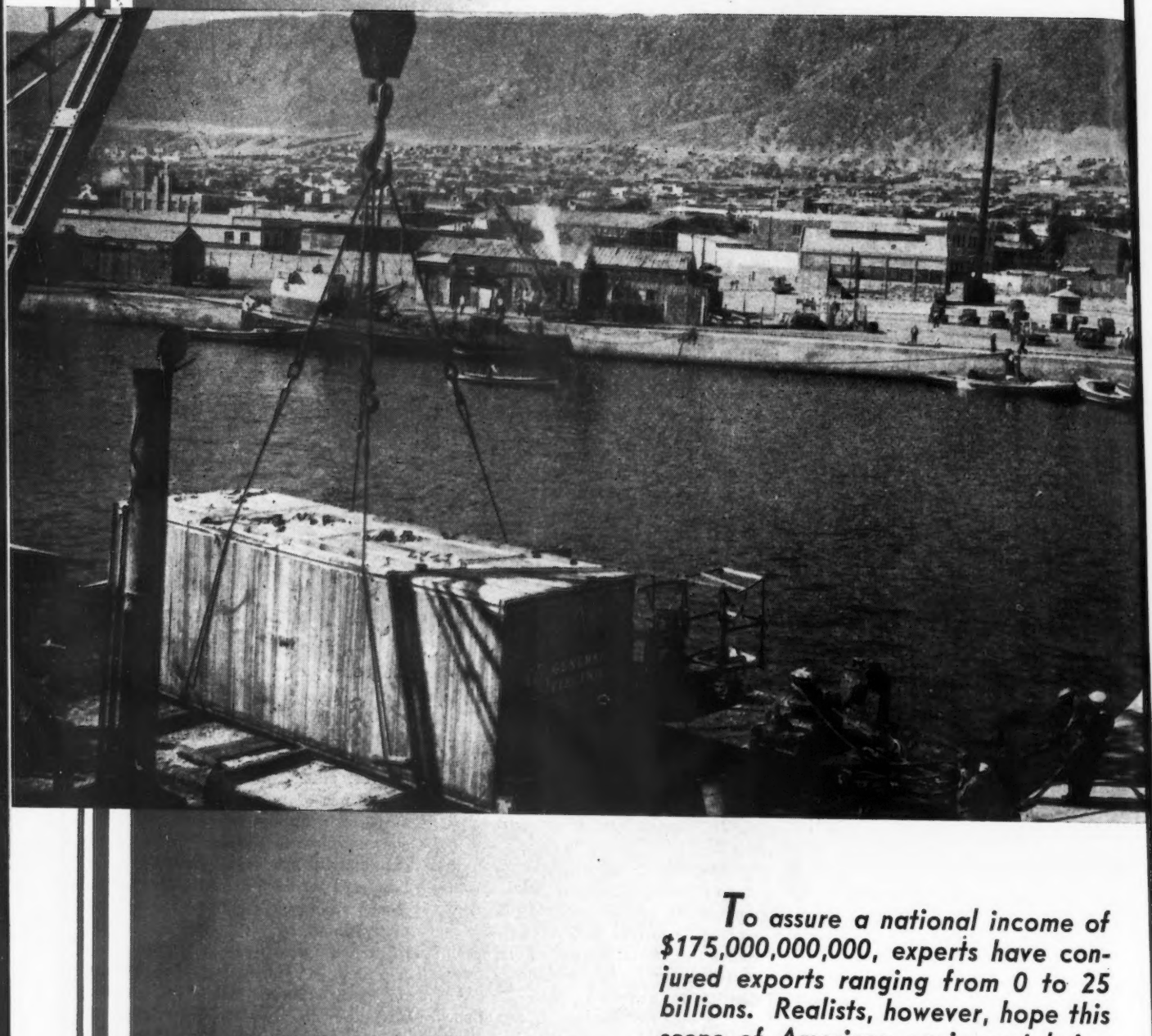
The use of indium, plated and diffused, as a protective coating on various nonferrous metals continues to expand. It has been successful as a lubricant for deep drawing dies where it has enhanced the life of such dies many times. A very important use is in airplane bearings. It is applied as a plated and diffused coating, chiefly on lead, cadmium, zinc, tin, copper, silver and gold plates. The diffusion, effected by heat treatment after electrodeposition, results in amalgamation, and the formation of a surface alloy which is corrosion resistant, non-porous and of increased hardness.

The surface alloy, copper, gold and silver will give a very high finish. The amount of indium used is minute, in most cases not over 5 milli-

(*Continued on Page* 180A)

Hanson-Van Winkle Munning Co. photo

TWO complete high speed caustic cleaning lines with delivery end in the foreground, at the plant of Weirton Steel Corp.



To assure a national income of $175,000,000,000, experts have conjured exports ranging from 0 to 25 billions. Realists, however, hope this scene of American equipment being unloaded at a foreign port will be repeated many times in many harbors.

Export

Industrialists, economists, and labor leaders look to an enlarged external as well as internal, market to maintain high-level postwar employment. All this requires less wishful thinking and more flexibility and aggressiveness in commercial policies.

By S. H. Barmasel

MANY of the unsettled issues facing the American people at the year's beginning involve plans to help make the transition from war to peace with the least possible dislocations. Reconversion, surplus equipment disposal, and veteran rehabilitation are only a few of the immediate problems involved in the shift to postwar "normalcy."

But as early as 1943 there already took root the realization among official and semi-official organizations that the United States' peacetime economy could not successfully function without a program for increased foreign trade. They considered such a policy not only essential for the immediate postwar era, when many war expanded industries will have greatly diminished domestic outlets for their products but necessary for the future maintenance of high levels of production and employment. This realization culminated in 1944 in two major conferences: the first, an inter-governmental parley at Bretton Woods, N. H., in July, and the second among businessmen of the United Nations at Rye, N. Y., in November.

On perhaps no other issue except the successful prosecution of the war was there such unanimity of opinion among businessmen, both large and small, and labor as on the broad outlines of America's policy concerning foreign commerce.

Robert Gaylord, then president of the National Association of Manufacturers, told the International Business Conference that the manufacturers of the United States recognize the following basic principles:

"If we are to export goods we must receive payment for them in raw materials and in the *manufactured goods* of other nations.

"If we are to export capital, we must be prepared to do so on a long-term basis and with the knowledge that it can be returned to us only in the shape of goods and services rendered by those who borrow.

"This can be done without lowering or adversely affecting the standards of our own country. In truth, we believe that it will increase our own prosperity, for before the war our best customers were the more highly industrialized nations of the world."

Eric Johnston, national president of the United States Chamber of Commerce, has been among the most outspoken proponents for a liberalized foreign trade policy. In a recent radio broadcast, he indicated that while foreign trade amounted to but 7 or 8 per cent of total production, it would account for the postwar employment or unemployment, based on projected employment figures for the U. S. of 55 million, of four and a half to five million American workers. To him, the only way in which America can maintain levels of high production, high employment and high wages is by increasing the volume of trade both at home and abroad.

Adding its voice to those of industrial leaders was the CIO which in its 1944 national convention proposed the "expansion of world trade by reducing tariff and other trade barriers and a willingness on the part of this country to take imports on a scale and in a manner conducive to stimulation of international exchange of goods."

Other organizations submitted their plans for the development of a sound foreign economic policy. The National Planning Association through the work of Stacy May called for a foreign trade budget of ten billion dollars which included imports, exports and foreign loans and investments. The Department of Commerce projected a figure of seven billion dollars. Others spoke of an external market between 25 billion and 40 billion dollars.

Throughout this harmony of views was interspersed an obligato of dissenting voices which for the sake of objectivity cannot be overlooked. Loudest of these is the American Tariff League. John L. Coulter, its consulting economist, sees a national prosperity in the postwar years independent of a foreign market. Catching up with a backlog for inventories; deterioration, obsolescence, increase in population, development of new fields and the continual rise in the standard of living to him is an assurance of full employment.

But the majority of informed public opinion links the American future with the export of commodities, services and capital.

Exports, however, cannot be isolated from the entire field of foreign trade and studied in vacuo. Simple cause and effect relationships, although a delight to the orderly mind, do not exist here. The prime factor influencing expanded exports is the maintenance of high production levels and in turn increased exports will help maintain high output levels.

Why American industry must operate at a high rate before it can export its products should be fairly obvious. The commodities sold in a foreign market have to be paid for in American dollars, and one method of acquiring these dollars is the purchase of foreign materials by American industry. Since most of the imports entering this country, about 70 per cent, comprise raw materials, a higher rate of production necessitates the purchase of more raw materials. Another group of imports are the luxury goods. And a man facing unemployment does not buy his wife a

bottle of French perfume, does not wear British tweeds nor dine on Russian caviar. American tourists have also contributed American dollars to foreign countries. In 1937 this amounted to $348,000,000 while in 1929, a more prosperous year, travel expenditures reached $483,000,000. Certainly a depressed economy precludes pleasure jaunts to European capitals.

But to reach the speculated figures of seven or ten billion dollars in exports, necessary to maintain a domestic production level of $175,000,000,000, increased imports of foreign goods will not in the long run contribute sufficient dollars to foreign customers. This will have to be supplemented by the large scale export of American capital. At present, however, many countries have available American dollars which can be used to purchase little or no American products. The armed forces abroad have been putting millions of dollars in the hands of foreigners. Another contributing factor to the unprecedented increase in gold and dollar holdings (according to the National City Bank estimates, these holdings amounted to 22 billion dollars at the end of 1944) has been the development of new sources of supply when enemy action cut off the United States from its regular suppliers of raw materials. Because of the earmarking of all production for the war effort, these countries have been unable to exchange the dollars it received in payment for goods made in the United States.

What has made so many Americans look to exports has been the devastation of huge areas of European productive facilities. While the war's effect on Europe has been to reduce its ability to produce, its effect upon the United States has been to expand its industries. This has been especially applicable in the case of producers of capital equipment. What the United States has most, the war torn countries need most. But as lend-lease dwindles, the money for the revitalization of these areas must come from private investors. The purchase of capital goods depends on long-term credit and it is here that private capital can find a source of profitable investment.

However, the experiences of the 20's and 30's have left a bitter taste. The irresponsibility of many of the foreign loans and the unstable economic conditions both here and abroad have conditioned many potential investors to fear such action.

The Bretton Woods Conference held this past summer attempted to overcome some of the obstacles to private investment in its plans for the establishment of the International Bank for Reconstruction and Development. The functions of the Bank would be twofold. It would make direct loans and also guarantee loans floated through private channels. The type of loans made or guaranteed by the Bank would be fixed by statute and could be used only for such reconstruction and development as has been recommended after careful scrutiny. The maximum loans made and guaranteed would be limited to its subscribed capital of 9.1 billion dollars. Risks would be spread internationally among the member countries including the United States, the British Commonwealth, France, Belgium, the Soviet Union, the Netherlands, Norway and others.

To support exports amounting to seven billion dollars annually, it has been estimated that foreign investments must amount to one billion dollars a year. To reach 10 billion dollars of exports, the export of capital must total three billion dollars. Since the International Bank is still in the stages of embryonic development, the government proposes an increase in the resources of the 10-year old Export-Import Bank from 700 million dollars to three billion. At present the Bank has available for new operations 200 million dollars.

Although the Export-Import Bank has for a decade been aiding the export of farm products and capital goods in collaboration with American banks, industrialists and exporters by underwriting short-term credits and making long-term loans for new projects, its activities are limited in that it can make no loans to governments in default to the United States.

The executive branch of the government is now trying to have this ban removed. Dean Acheson, Assistant Secretary of State, told the House sub-committee on foreign trade and shipping that "it would be desirable to remove the ban imposed by the Johnson Act on private lending to governments in default to this government. That Act, as well as the provisions of the Export-Import Bank statute was directed at governments in default on debts arising out of the first World War. Conditions have changed greatly since this Act was adopted but it still stands in the way of extension of urgently needed loans to the principal European governments and is therefore a barrier to American participation in the rehabilitation of international trade. The unavailability of private capital, due to the Act, increases the need for government loans for reconstruction and other purposes."

A second stimulus necessary for foreign investments, and foreign trade as a whole, is the stabilization of foreign exchange and the easy conversion from one currency to another. At the Bretton Woods Conference, the participating nations attempted to provide the machinery for such stability and transfer in establishing an International Monetary Fund. Like the International Bank, the Fund is still being hatched and no definite exchange values have been set.

Opposition to the Bretton Woods monetary policy has been sounded. The National Industrial Conference Board fears the establishment of a cheap dollar in foreign exchange; while Winthrop Aldrich has suggested that stabilization of world currency in concert with the traditional stabilization of the dollar-pound rate be substituted for the monetary fund plan.

Because of the association of the export of capital with imperialist policies, Dr. August Maffry, economist for the Bureau of Foreign and Domestic Commerce, suggests that these investments involve no substantial degree of alien control of natural resources and industries. He further adds that "so far as private capital is concerned, foreign investment after the war should, to the maximum extent possible, take the form of equity or direct investments. Such investments are much less a burden on the international exchanges in periods of declining trade because they are subject to variable returns in local currencies rather than to fixed charges in dollars."

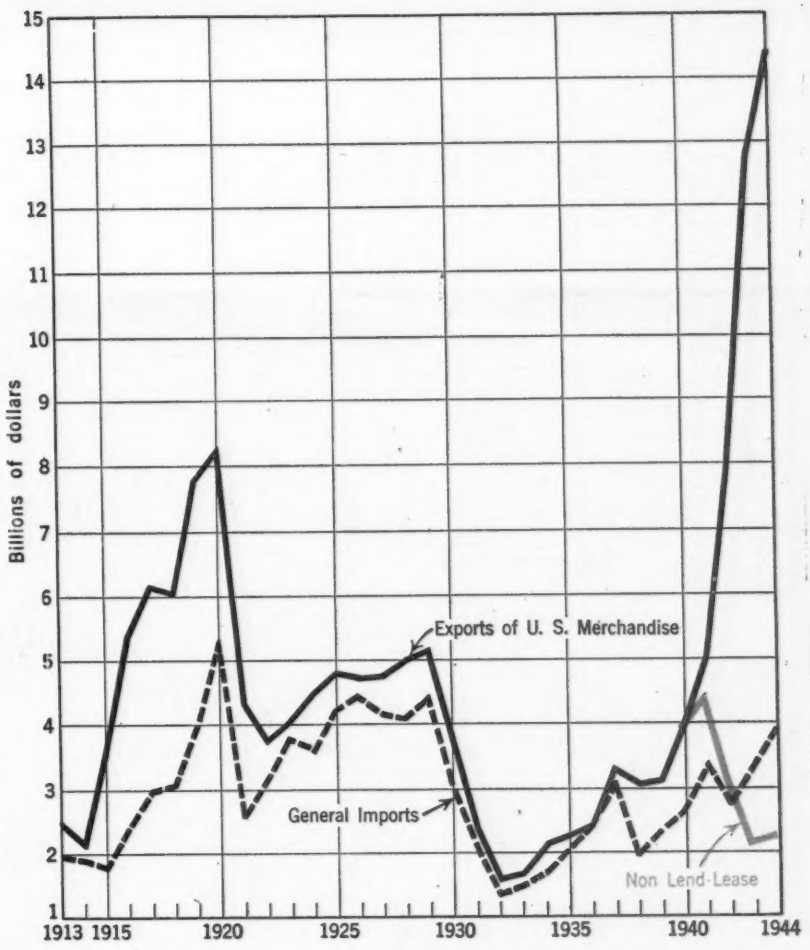
The flow of American capital into foreign lands leads ultimately to the reconstruction of already industrialized countries and the beginning of industrialization in countries heretofore primarily agricultural. Whether the building up of industries in backward countries would be advantageous to the United States is still a moot question, but the balance is rapidly swinging to the affirmative opinion.

It is pretty obvious to all that industrialization would result in immediate gains for the United States in the sale of capital goods. Some hold to the opinion that this would be in competition to the pent-up domestic demand for durable consumer goods and that many Americans would be forted to wait for their

automobiles, washing machines, refrigerators and radios while the United States supplied the rest of the world with their needs for steel mill equipment, machine tools and other machinery. And after the needs of foreign countries for capital goods is fulfilled, does not the United States in the long run lose these customers? The same forces that operate in the United States also operate in other countries. When industrial operations reach a high level, purchasing power increases and consequently imports do too. Poor peasants do not indulge in the luxury of automatic toasters, electric washing machines and short wave radios. As the demand for capital goods decreases, the demand for consumer goods increases. That highly industrialized nations become the best customers is clearly illustrated by the fact that the United Kingdom has consistently led all others in taking goods marked made in the U.S.A. For the five years 1936-40 exports valued at $602,744,000 were sent to Great Britain.

Although it is highly improbable that a high volume of imports will reach this country right after the cessation of hostilities, if the United States expects to export upwards of seven billion dollars, it must take into this country foreign goods valued at six billion dollars. This can be done only by the lowering of tariff barriers. Proponents of the policy of tariff reductions hold that tariff restrictions are a holdover of early nineteenth century thinking when a favorable balance of trade was all important and are no longer applicable. The United States by its superior equipment, techniques and skills need not fear foreign competition, they say. World trade with its resultant increased employment and production would not tend to lower the American standard of living, they answer their opponents, but on the contrary would work towards increased prosperity. Another advantage to increased imports would be the conservation of raw materials in this country that are either declining or nearing depletion because of the tremendous draining effect of war output.

Tariff reductions cannot come about as a unilateral action of the United States. Other nations must be equally ready to accept foreign products and it is likely that another international conference will be held to settle the problem of tariff restrictions. However, the Reciprocal Trade Agreements program initiated by former Secretary of State Cordell Hull already provides a precedent for future action should over-all tariff reductions fail.



EXPORTS and imports of merchandise from 1913 to 1944. Export data for the years beginning 1941 are separated into all exports including lend-lease and non lend-lease shipments only. (Based on Department of Commerce data.)

Although much depends on what constructive action is taken by the government in relation to guaranteeing loans, currency stabilization and tariff adjustments, the future of American export trade in the final analysis depends on what plans American businessmen are now making in regard to foreign trade.

It was for this purpose that THE IRON AGE submitted a questionnaire on plans and attitudes to companies in the metal working and metal producing fields. It was hoped that conclusive data could be collected. However disappointing the returns, the results are nonetheless significant.

From the returns received, there is conclusive evidence that the bulk of metal working companies that did not sell their products in the foreign market before the war do not intend to enter this field. Because of this lack of interest, it is believed that returns were scanty. Only 6.9 per cent of those polled, returned their questionnaires. In some cases, it may be that export projects are still in the amorphous stage. Because of the low percentage of participants, all figures and conclusions must be modified as to their conclusiveness. But trends are indicated and for that purpose this poll is of value.

Of those companies that did not export their products in prewar years, 72 per cent did not intend to extend their marketing policies to reach foreign customers. Of the remainder, or 28 per cent, who intend to export, after the war, 20 per cent plan to establish an export department, thus indicating the degree of concentration of marketing promotion planned. Those that will designate an official of the domestic sales department for this purpose and those that will utilize an outside export organization are equally divided, 40 per cent for both methods.

For those that had exported before the war, 46.5 per cent had a separate export department. Of these, 83 per cent employed 500 or more, 13.5 per cent, employed between 200 and 500

(CONTINUED ON PAGE 180A)

This rich ore pouring into the hold of the steamer Norman B. Ream at ore docks of the Duluth, Mesabi and Iron Range Ry. is symbolic of the greatest steel drive in U. S. history.

Ore & Coal

Ore deliveries failed to match expectations and coal production dropped under the 1943 record. Stocks on hand, however, are adequate for all foreseeable contingencies, although labor's fight for higher wages may easily cloud an otherwise satisfactory picture.

By W. A. Lloyd

THE steamer Amasa Stone cleared the Ashland harbor on the morning of November 28, carrying Lake Superior's final iron ore cargo of the 1944 season. A total of 81,170,538 gross tons of iron ore had been brought down, not as much as originally planned, and somewhat under the 90,000,000 ton quota set by WPB's Iron and Steel Advisory Committee. However, it was enough to swell the aggregate of 1941, 1942 and 1943 to 337,768,531 gross tons, not including the movement of ore by railroad from Lake Superior mines.

Weather, always an important factor, was a gracious ally in 1944; boats got an earlier start and were favored with freedom from the meteorological onus of fog, a pleasant respite after 1943, a season so foggy that one captain stated he had encountered fog on either the up-bound or down-bound movement on each and every trip for the first time in his experience.

Furthermore, there was no time lost in steaming late ore cargoes, marking the first war year that thawing, usually a late-season adjunct, was unnecessary: This came in pleasant contrast to 1943, when 71,935 cars of ore were steamed, and to 1942, when over 60,000 carloads underwent the steaming process.

Perhaps partially responsible for this is the fact that for the first time in many years no ore was moved from Lake Superior ports in December; but in December, 1943, 749,512 gross tons were sent down, and in December, 1942, 635,829 gross tons went forward. Total for December, 1941, was 835,081 gross tons.

But despite the earliest closing in recent years, the Lake Superior district had produced its usual proportion, 85.2 per cent, of the output of U.S. mines; last year the district's total was 85.9 per cent, and in 1942, 85.7 per cent. Once again, it seemed, the ore industry had gotten together and done a job.

A maximum number of ships was in service this year, and while it varied from month to month and finally dropped down at the end of the season, there were 303 U. S. vessels and 12 Canadian in service, and all the new boats built by the Maritime Commission were being used.

This augmented fleet had a trip capacity of 2,940,090 gross tons at 20-ft. draft; the Canadian vessels were smaller and carried ore intermittently. During the season, one ore boat, the Frank Reed, was lost, on April 27, in a fog, taking the lives of 12 men, and the steamer Humphrey, sunk in the Mackinac Straits in 1943, was raised and part of her cargo salvaged.

Peak employment at the mines hovered around the high of 1943, when 24,000 people were employed in ore mining, including office and clerical help, and about 15,000 men were on the lakes in ore traffic. But all is not calm and bright on the labor front, for manpower is getting tighter, and adding to the problematical chorus are the demands of the same group that applied for a wage increase in the steel industry, the CIO-USWA, and granting this increase may easily occasion broad implications for the Lake Superior iron ore operators.

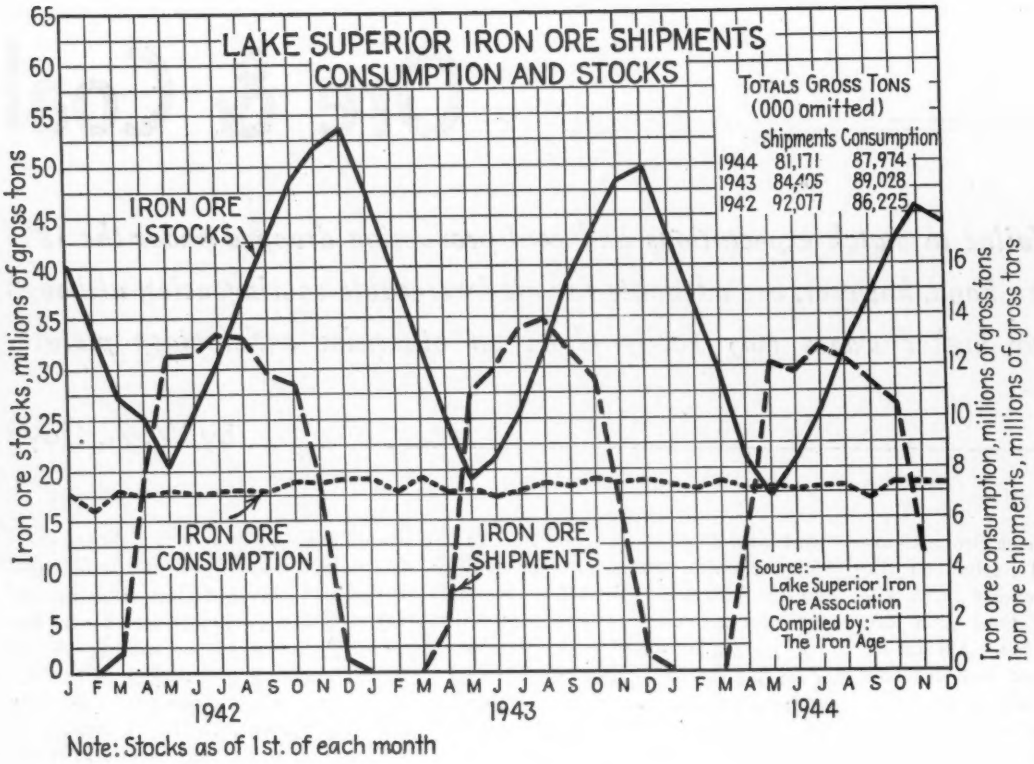
Already pressed by rising costs, some ore executives have inferred that wage increases might mean some rather considerable curtailment of district underground mining operations, and the feeling seems to be that no underground mine could survive under the additional burden. This, of course, would mean that the Cuyuna, the Menominee, the Vermilion, the Gogebic, and the Marquette Ranges would eventually be closed down, leaving only the open pits on the Mesaba.

It has been said that to mine one ton of underground ore costs five times as much as the mining of one ton of open pit ore, and since the underground mines, obviously, provide the employment, further increases in operational costs may result in a relation even more disproportionate than the one currently existing. Certainly steel companies, long noted for their realistic approach to such problems, will not keep mines open simply for the support of mining towns, while in the interval, the poor, or underground mines get poorer, and the rich, or open pit mines, get richer.

But there lay still a further note of sober reflection beneath the industry's fourth season of wartime achievement; current tonnages were omnipotent in the record books, but they also meant tremendous drains on reserves in the ground. In meeting the emergency of this war, and the last one as well, the nation's most important raw material was being depleted, automatically posing the question of whether or not the industry can meet again in 20 or 30 years the proportionate increases of another national emergency. And Dumbarton Oaks offered no guarantee that this would not be necessary.

Global war's stringent demands were met this time because the ore came from open pits in the Mesaba range, and with a million to 10 million tons annually coming from individual pits, but even 500,000 tons coming from an underground mine would mean a large-sized operation.

Perhaps the answer lies in beneficiated ores, since sooner or later, 25 per cent ore must be used and at a great capital charge, and this "long look reserve" is definitely the indus-


LAKE SUPERIOR IRON ORE SHIPMENTS
CONSUMPTION AND STOCKS
TOTALS GROSS TONS
(000 omitted)
Shipments Consumption
1944 81,171 87,974
1943 84,405 89,028
1942 92,077 86,225
IRON ORE STOCKS
IRON ORE CONSUMPTION
IRON ORE SHIPMENTS
Source:
Lake Superior Iron Ore Association
Compiled by:
The Iron Age
Iron ore stocks, millions of gross tons
Iron ore consumption, millions of gross tons
Iron ore shipments, millions of gross tons
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1942
1943
1944

Note: Stocks as of 1st. of each month

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ORE stocks at the beginning of 1945 were at the lowest point for several years, but shipment facilities can well take care of requirements for the fourth year of war. The drop in consumption in 1944 may be followed by a new record peak in 1945.

o o o

try's most important question at the moment, since an operation like that in the Lake Superior region goes on no place else in the world today.

As a demitasse for the 1944 season, the Steep Rock mine got into production this year and shipped one cargo and parts of two or three others, totaling 16,000 tons. Estimated output of Steep Rock for 1944 was 500,000 tons, a million tons in 1945, and at least two million tons thereafter is anticipated. Particularly rich in iron content, with low phos and silica, experts expect it to be widely required for open hearth use as a premium lump ore.

Reflecting the general and fallacious feeling that the war in Europe would end last Fall, the dropping off of the ore movement after contemplating a higher tonnage will result in consumers carrying over less ore than normally. Indications are that ore consumption was off in November, but the current resurgence in the increase in steel capacity operations presumes that ore consumption will go on about the same, roughly 7,300,000 gross tons a month.

Current programs negate any indication of a decline in ore consumption, which means that stocks on hand at the beginning of the season will constitute a smaller inventory than usual; three years ago it was about 20,000,000 tons, this year it may be about 14,000,000 tons. And it may be significant to note that consumers are not concerned and seem to believe supplies are sufficient to get them by.

Coke had its peak demand in 1943, and the tonnage in the year just past was not as great, with the demand simmering down. High-lighting the 1944 season, however, was the adequacy of the coke supply, enhanced by the by-products and beehives that came in, helping the mills to maintain a 97 per cent capacity. Second only to the adequacy in importance was the continuity of operations, which helped a good deal and reflected the mine labor situation, also a significant factor, stemming from the Ickes-Lewis agreement of 1943, and while there were a few sporadic difficulties last year, it was nothing like the past.

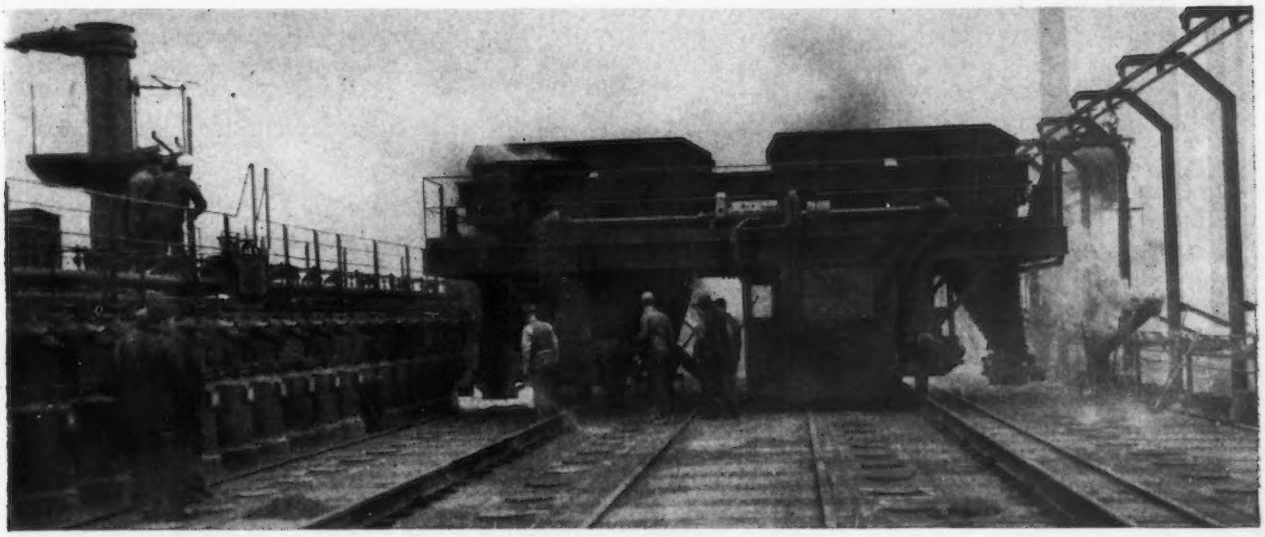
Future difficulties are not beyond the pale of anticipation. However, with negotiations for new wage increases scheduled for the first of March, it is hardly essential to point out coal's connotation to the steel industry, since approximately 18 per cent of the 600,000,000 tons of coal mined annually goes to the mills.

Beehives, banally bracketed as bottlenecks a year ago, have made it possible to move coke into the domestic trade this year, and beehive coke dumps, where it was screened back in 1900, have been supplying coke, after re-screening, to commercial users.

In the past, when the steel demand was surging and coke requirements for the blast furnaces were hitting new highs, beehive coke ovens furnished a strategic part of the coke. But in 1944, there were ineradicable signs that the halcyon days of the beehive coke industry were numbered,

Annual Coke Capacity of Pig Iron and Steel Producers
(Net Tons)

As of	By-Product	Beehive	Total
January 1, 1942	50,291,830	4,239,975	54,531,805
July 1, 1942	50,308,530	4,613,625	54,922,155
January 1, 1943	51,707,830	5,756,400	57,464,230
July 1, 1943	52,625,830	5,455,800	58,081,630
January 1, 1944	56,574,430	4,875,550	61,449,980



CHARGING coke ovens at a Defense Plant Corp. unit, Republic Steel Corp., Warren, Ohio. The overcoming of by-product deficiencies by construction of such plants as this sounds the death knell of many beehive installations that bolstered steel production early in the war.

except possibly for that segment (about 50 per cent) in western Pennsylvania, which is owned and operated by the steel companies themselves.

Previously, in normal peaks, beehive coke ovens supplied about 10 per cent of the blast furnace coke needs because of by-product plant deficiencies in periods of abnormal demand. In the past few years, however, the increase in by-product coke capacity, because of expansions, will probably take care of future blast furnace needs, and this declining requirement for beehive furnace coke comes at a time when the industry is in the sunset stage of its existence.

Recalling times past and gone when as many as 35,000 ovens were in operation at Connellsville, Pa., regions—in the past two years the number in operation has been about 9000 in that territory, and many of these ovens have served the domestic trade because of the lack of good coking coal. Years ago, coking coal was available right at the ovens, but in the past several years operators have had to go as far as 25 miles to get coal for coking and even at that distance, the quality has been such as to cause many rejections of the resultant coke.

Right now, it seems that next year's coal supply will be ample, but manpower, multi-pointed thorn in productivity's side, may become a big factor. If coal mines are considered sufficiently essential to prevent the drafting of men from 27 to 37, there will be sufficient coal. Harbinger of things to come, the little fellows in strip mines have been slowly closing down, and inasmuch as steel companies dig only about half the coal they use and buy the rest, J. L. Lewis will have something to work on when negotiation-time comes, especially if the prediction that the mills will average 80 per cent capacity this year becomes an eventuality.

Coal movement on the Great Lakes totaled very close to 60,450,000 tons, on the basis of reports in and compiled for the shipping docks on Lake Ontario, the dock at Chicago, and all Lake Erie docks except Toledo, where shipping will continue to the Detroit River district as long as weather permits.

Close to 10,000 tons above any season movement of past years, this coal movement compares with the 28,153,317 tons handled by the lake fleet in 1918, peak lake coal shipping year of the first World War, and provides some insight into the close cooperation that has existed all year between the mines, railroads, lake carriers, and the shipping and receiving docks.

Docks on Lake Ontario loaded 3,558,577 tons into lake freighters during the season; Chicago's dock dumped 1,588,843 tons, practically all of which was for use by Canadian Railways, and the Lake Erie docks, up to late December, had dumped approximately 55,300,000 tons.

Detention of railroad cars at lake shipping ports was reduced to the lowest point in lake shipping history. Detention at Lake Erie ports averaged only 3.31 days per car; at Lake Ontario ports, 3.61 days per car; and at Chicago, only 2.74 days were required. Every vessel received its scheduled coal, in almost complete contrast to the 1918 movement, and the delays to vessels at loading ports was a record low.

With the U. S. steel industry expected to consume a daily average of 249,000 tons of coal this year, movement down the Great Lakes assumes new facets of significance.

Now, as Lake Superior's iron ore producers are in the throes of an extensive program of preparation for the traffic, perhaps tremendous, of 1945 it looked like a busy winter. There was lots to do; stockpiling against the opening of navigation next Spring, removal of over-burden from mine areas for open pit operations next summer, and the installation of new equipment. But over it all lay the war's huge, pervasive question mark.

Since December, 1941, the steel plants of the United States had produced more than 263,000,000 tons of steel ingots and castings, nearly 80 per cent more than production in the three best years of World War I and surpassing by nearly 55 per cent the maximum tonnage produced in any peacetime period, and iron ore had been the basic element in the manufacture of this mountainous morass.

While big guns boomed along the Ruhr, an ore industry here looked thoughtfully at the record books. Winter storms were lashing the lakes and a fleet that did not sweep over them in vain lay moored in quiet winter berths; spring and the end of the war had never seemed farther away.

Efficient chip handling systems have been necessary to maintain the scrap flow from the machinist back to the steel mill. This is just a few hours' salvage from one machine turning one small part for the Cyclone engine.

Scrap

Up, down, and now up, pressing hard against ceiling prices. The current tight supply condition will likely soften somewhat after the turn of the year. Meanwhile, dealers who become brokers have a decision to make regarding their future market activities.

By T. E. Lloyd

IN the past twelve-month period, the scrap market has undergone its greatest change since the beginning of the war. Production swung into high gear, scrap began to move a little more freely, and, for the first time in nearly four years there was relative plenty in so far as supplies were concerned. With the improvement in scrap availability, an inevitable price break occurred. This was the first commodity placed under governmental price control as a war measure that has undergone a break in price structure. This is understandable in view of the extreme sensitivity of scrap to supply fluctuations.

The break came early in the year. As early as February, scrap supplies throughout the country, especially in low-phos and alloy turnings and borings, were sufficiently in excess of requirements to cause weakness in price. This was followed by the gradual weakening in prices of all grades except cast items, and by the end of August prices had broken across the board to the extent that the quotation of OPA ceiling prices was useless. At that time THE IRON AGE reestablished its open-market scrap quotations, thereby publicly recognizing the fact that the OPA ceiling prices no longer were the minimum as well as the maximum prices paid for scrap.

Fearing that a loss of civilian interest in scrap collections would be damaging to morale, there was considerable pressure brought to bear on the industry to cover up the fact that scrap supplies were in excess of demands during the early weeks of the break in prices. In March, the WPB offered criticism of the reports by THE IRON AGE that prices were breaking and that some grades were not moving. WPB emphasized the critical shortage of heavy carbon grades, but in effect closed its eyes to the surpluses of the less desirable grades that were accumulating throughout the country. Charges were made by various people from time to time that the mills themselves were trying to break down the price. This was probably quite true in specific instances, but, on the whole, any concerted efforts by the steel industry to break scrap prices tended only to weaken their plea to the OPA for higher finished steel prices. Consequently, it is difficult to reconcile these two objectives.

The main point, however, is the fact that by the beginning of August the mills had what they felt was a sufficient supply of scrap on hand to last them for quite a while, and, together with the scrap dealers, the mills felt that the war was almost over in Europe. Neither dealers nor mills wanted to be caught with excessive stocks of scrap, for which they paid ceiling prices, when the prices dropped at the close of the war in Europe. This optimistic feeling inevitably followed the invasion of Europe, the rocket-like drive through France, and favorable progress reports by such respected leaders as Churchill, Eisenhower, Montgomery, and others.

Now that the war in Europe promises to last longer than anticipated, optimism has worn thin, and both the steel and scrap industries are now squared around for months more of fighting with its natural accompaniment of high steel production and heavy scrap demands. Evidence of this fact was the rapid climb from a low of about $15.75 a ton for No. 1 heavy melting scrap in the last week of October to the ceiling price by Dec. 7.

An examination of scrap consumption, inventory and production figures over the past three years, shown in Table I, offers no basis for easing of scrap supplies or the breakdown in price in August. At no time were inventories excessive, and especially is this true during the past nine months, as can be observed from the downward trend shown in Fig. 1. There has been a general decline in inventories since the peak in December, 1942. On Dec. 31, 1942, total stocks amounted to 6,930,000 gross tons. Of course, this tonnage was largely accounted for by the scrap drive in October, 1942, which by December had been pretty well tallied in so far as volume was concerned.

However, from December, 1942, inventories stayed above 6,000,000 tons until April, 1944, and since that time have ranged around 5,900,000 tons. On the other hand, scrap consumption has fallen only during the past seven months. The peak in consumption was hit in March of this year, when 4,827,000 gross tons were consumed. Currently, the monthly rate of consumption is estimated at between 4,400,000 and 4,500,000 tons, which is not a decline of any moment.

This would indicate generally, that the steel industry is working with not more than a 35 to 40-day supply of scrap on hand. Production of scrap by railroads and manufacturers is running now about 966,000 tons per month, having dropped off from over 1,000,000 tons a month that was produced from March through June. Over this railroad and industrial generated scrap is a steadily declining volume of what might be termed salvage scrap. This is scrap that is normally classed as auto wrecker and dealer scrap salvage and is calculated by deducting shipments to suppliers by manufacturers and railroads from shipments to consumers by suppliers, and then adding suppliers' stocks at the end of the month and deducting

stocks at the beginning of the month. In other words, this is the new scrap coming into the yards each month from other than railroads and manufacturing plants. While the drop in actual volume has not been too substantial, nevertheless there has been a steady decline for the past year and a half.

All of these things point to one conclusion. While there has been a steady decline in the production and availability of scrap and only a minor decline in scrap consumption, nevertheless something happened in the third quarter of last year to bring sufficient quantities of scrap to the surface to break the price.

As pointed out, war optimism was the chief cause. Secondary to this was the fact that mills, which had their first breathing spell after three years of peak operations, began to clean house. They worked off undesirable scrap, broke up ladle skulls, broke up and used worn ingot molds and buttons, and cleaned up their plants. Furthermore, as the price began to break, they held off buying scrap unless scrap was immediately needed, figuring the price would continue downward. As long as they stayed out of the market, the price did continue downward. Finally, it hit bottom, with THE IRON AGE composite somewhere in the neighborhod of $15.50 to $16.00 a ton, and by that time the mills were pretty well cleaned up and had to re-enter the scrap market. In Pittsburgh, the first upward break was the purchase of some 25,000 tons of railroad scrap, industrial scrap, and some shipyard plate by the United States Steel Corp. The Mingo plant of Carnegie-Illinois Steel Corp., which had been engaged in producing synthetic scrap in Bessemer converters, was closed down, reducing the Corp.'s scrap supply by about 9000 tons. This made greater scrap purchases necessary. When this sale became known, the price began to move upward, more mills began to purchase scrap, and dealers and brokers found themselves in a tight spot to cover short orders in an advancing market. In fact, to cover part of the Steel Corp.'s order, which was sold short on a flat $17.75 a ton basis, the broker that took the order paid as much as $20.00 a ton to cover part of his order.

As the price began to advance in late November, scrap became very scarce. This, with the approach of cold weather, created a desire to buy more heavily. No. 1 heavy melting scrap just about disappeared from the market, and all dealers and brokers stopped selling short with the realization that they would be unable to cover their position. The unavailability of scrap during late November and December could be laid at the doors of the producers, both industrial and railroad, and to the dealers. Industrial plants and railroads, realizing the price was advancing, refused to sell on the hopes that scrap prices would again rise to ceiling. In fact, even after some railroad scrap lists were published, they were recalled by the railroads and selling was stopped. Dealers, who on the whole were paying high percentages in excess profits taxes by December, felt that they might as well keep the scrap until after the first of the year, since any profit they made on it would go to the government in taxes. Furthermore, they had the "dollar sign" on their minds too, as several indicated that if WPB would allocate the scrap to a mill they would be perfectly willing to ship, since allocations are made only on ceiling prices.

The whole picture was, by December, quite confused and a bit baffling even to the dealers and brokers. They worked on a day-to-day basis as far as sales and price were concerned. They would make no predictions except that after the first of the year scrap would be more available, and prices again might soften.

Looking at the scrap picture from the industry's standpoint, the war has made some major changes that will have to be straightened out before too many months pass by. When price controls, allocations, manpower difficulties, and equipment shortages set in some two or three years ago, the yard operator was squeezed in the vise of preservation of business and the desire to quit. The yard dealers, acknowledged to be the backbone of the industry, were beset by a multiplicity of troubles. Manpower was taken away by the draft and by better paying industries. Because of the normal low wage rate and the wage freeze, labor that was draft exempt

TABLE I

Inventories and Consumption of Scrap, and Production by Railroads and Manufacturers*

(000 Omitted)

Month		Inventories On Last Day of Month, Gross Tons	Consumption, Gross Tons	Industrial Scrap Production, Gross Tons
1942	January	4100	4425	531
	February	4073	4204	514
	March	4101	4661	600
	April	4324	4603	616
	May	4602	4665	626
	June	4859	4464	641
	July	5087	4470	644
	August	5279	4478	696
	September	5545	4424	758
	October	6260	4770	832
	November	6742	4401	755
	December	6930	4497	765
1943	January	6877	4492	775
	February	6871	4178	806
	March	6850	4787	959
	April	6918	4642	954
	May	6905	4723	925
	June	6916	4493	913
	July	6860	4570	897
	August	6778	4686	912
	September	6613	4657	910
	October	6456	4830	956
	November	6391	4581	948
	December	6458	4449	931
1944	January	6214	4616	937
	February	6134	4414	953
	March	6027	4827	1031
	April	5932	4629	1017
	May	5966	4683	1038
	June	5991	4460	1008
	July	5909	4423	926
	August	5975	4543	985
	September	5983	4471	966

* Bureau of Mines Data.

funnelled into better paying jobs in shipyards, tank arsenals, and other war plants. Typical of this were the burners, who made 75c. to 80c. an hr. in eastern yards, moving almost to a man into shipyards and taking jobs as welders or flame cutters often at double this base rate plus heavy overtime pay. The same was true of the collector or "junkie," who is now classed as an almost extinct species.

Equipment that would save on manpower in the scrap yards began to wear out and was not replaceable. Shears, balers, presses, cranes, and other such items broke down, doubling or tripling the need for manpower which was steadily being reduced. Of course, some help was given the yard men for repairs on equipment, but on the whole it was inadequate because most yards would have bought new to supplement what was on hand had it been available.

All these difficulties slowly piled on top of each other, the whole gathering momentum until the total effect was ponderous. It did one thing. The yard dealer, to stay in business and earn a living, had to handle his business in another manner. Because of financial investments in properties and equipment, he was forced to stick to his last and stay in the scrap business. Furthermore, an incentive was offered the yard man which erased any doubt he had as to what procedure he should follow. That incentive was the 50c. a ton OPA sanctioned brokerage fee.

Yard dealers were brokers immediately. They handled as little as possible in their yards, processed as little scrap as they could, and acted only as an agent between the producer and the consumer. Because the scrap flow was steady, mostly of an industrial nature, and because public sentiment was behind them, the scrap dealer became sort of a hero. Collecting 50c. a ton brokerage commission was better than sweating over a yard full of unprocessed scrap with no help and a lot of broken down equipment.

After three years of this easy life, the ex-yard operators now are faced with another decision. Should they stay in the brokerage business or should they go back to the yards? Some rather lush living with not too much work has convinced many that they are born scrap brokers. The future will determine whether this self-analysis will equal the rigors of competition in the offing.

Without yards to draw from brokers normally cannot exist. Furthermore, the big brokers need many, many yards to keep a steady flow of scrap coming in so that they can have what they need when they need it. These same big brokers, according to the opinion of the writer, will spend money to insure and protect these sources, and by protecting these sources is meant that they will spend money to put yard operators back in the yards.

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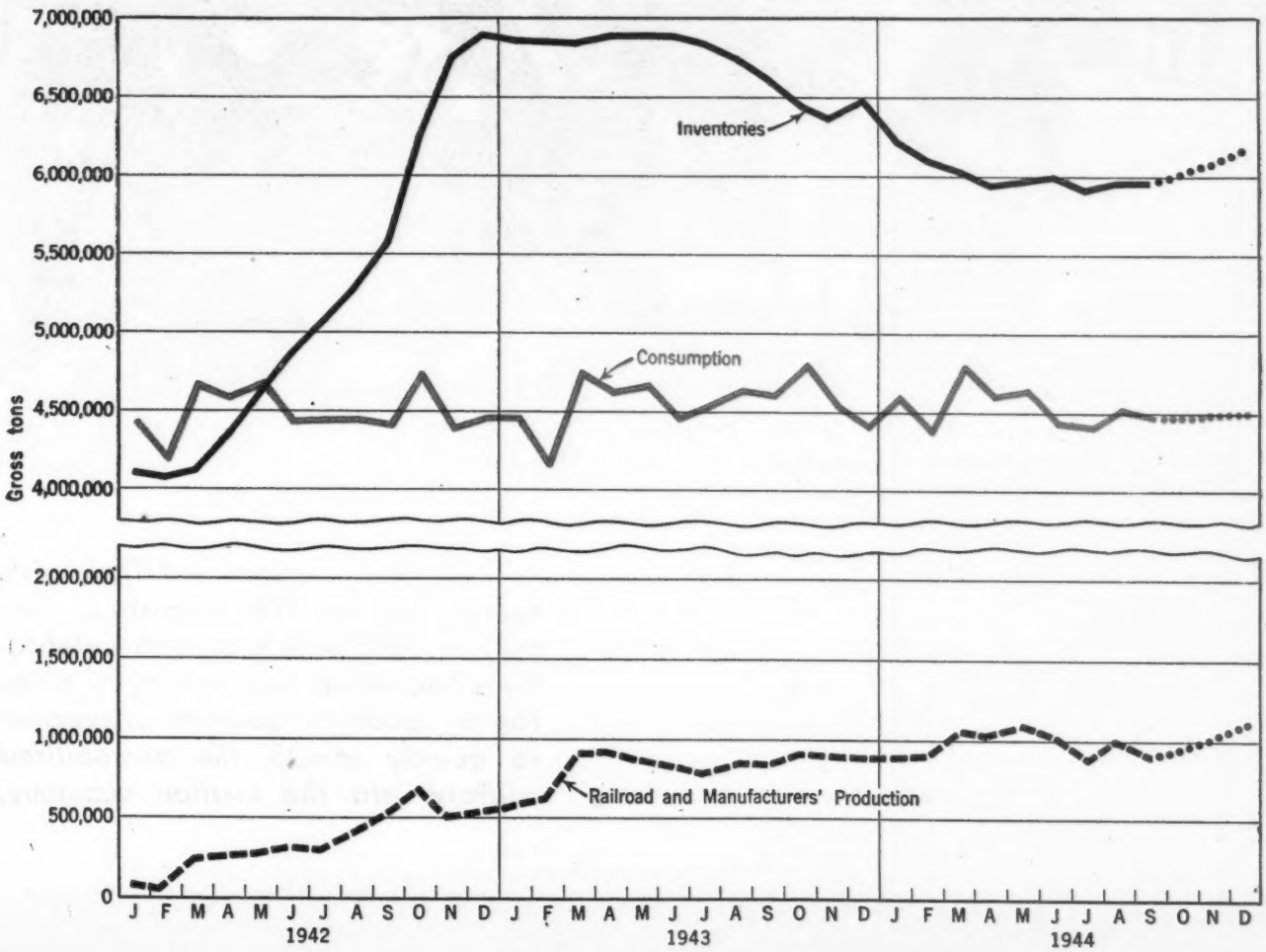
FERROUS scrap inventories, consumption of scrap, and production by railroads and manufacturing plants. In gross tons. Compiled by THE IRON AGE from Bureau of Mines data.



Soldiers, sailors and their girls celebrating the 1918 Armistice. Victory in 1945 will find such celebrations backed up by a variety of plans for a speedy industrial conversion to quickly absorb the demobilized military into the civilian economy.

Reconversion

Civilian goods production, hesitantly paced by a trickle of spot authorizations, calls for intensive planning on contract cleanups, plant clearances, labor seniority. Predetermination of contract settlements is the immediate objective for rapid absorption of manpower.

By Stanley H. Brams and John Anthony

SOMETIME ahead, maybe soon, maybe later, the biggest factories and the busiest front offices in America will go into a new business —reconversion. Whether piecemeal or overall, reconversion at once may be the most uncharted course American economy has tried to follow, the most laden with pitfalls, the most hurried. At its end may be a pot of gold or the bitter broth of disappointment.

The mechanics of starting the return toward a civilian economy along Reconversion Road have been pondered for many months by industry and government. The first fruits of that thinking came last summer, in the loosening of restrictions on machine tools, aluminum and magnesium, experimental model development, and civilian goods output. Later the granting of permission for the Johnson Co., Houston, Tex., to make septic tanks started off a list of spot authorizations to make civilian goods which now includes 1400 firms, and whose developments will be summarized later. More recently these spot authorizations have been halted in critical labor areas until March, but they symbolize America's planning for peace.

The problems of complete reconversion are profound. The primary considerations involved are—

Permission to clear factories of war goods machinery must be forthcoming.

Fair compensation for half-completed contracts must be arranged.

New equipment must be obtained to replace that sold, loaned, lost or obsoleted in the war.

Postwar models—whether automobiles or appleslicers—must be engineered for production.

A basis of labor rates must be evolved to satisfy workers accustomed to overtime-swollen checks, and to satisfy another social group, the entrepreneurs, who are wearied of profitless operations.

Policy must be developed for those veterans—certainly more than two million—who went from school to uniform, who lack seniority to secure a job, who will meet only frustration at the factory gates overcrowded with regular workers who stayed home and prewar workers who have returned.

American business and government must consider both the physical sides and social sides of reconversion. Well-integrated production lines may quickly become erratic and uncertain if they run in the sight of hungry, angry men. Willing, strong workers will weaken under idleness caused by lack of work for them. And idleness will breed depression again.

Against these notes is a brighter tone. The potential market ahead for civilian goods is of size and proportion to provide momentum for industry as has never been known before. The buying of the days of 1928 and 1929 will be duplicated and surpassed, but this buying will not be frivolous, built on a dangerously over-extended credit plateau. It will grow from sheer need sprouted from better than three years of stoppage of normal production, backed up earlier by the depression thirties.

Government is playing a dual role in the broad field of reconversion planning. The national legislature and many administrative agencies have created and are implementing regulations which provide a legal framework for the ultimate transition. These same bodies are likewise engaged in postwar planning whose aspects inevitably bear on reconversion thinking.

The War Production Board has enunciated the policy that its objective is to go out of business as rapidly as possible. The end of the European war can be expected to generate the basic assumption that no materials shortages and no production allocations will be necessary to maintain an armament flow large enough for quick victory over Japan. Industry applauds this stand, but at the same time realizes the possibility that it may contain the seed for diverse opinion in Washington which may slow down reconversion. This viewpoint grows out of the likelihood that the military—quite logically from their standpoint—will insist that nothing stand in the way of war production for the Pacific theatres. This attitude, quite naturally, would favor the maintenance of fairly rigid controls over civilian goods production; and certainly industry will find no quarrel with this standpoint if it has a shred of justification. At the same time, however, it is quite apparent that if WPB does shrivel to miniscular size, and if the Army establishes its case fairly well in the eyes of public opinion, quasi-military controls may be established over industry far more difficult than the actions taken in Washington in the policy-making offices of WPB in the Social Security Bldg.

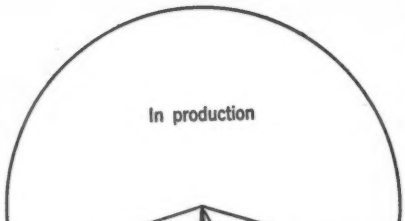
For a time the mechanics of postwar planning were being worked out by a baker's dozen of Washington agencies, all apparently scrambling for a future place in the transitional sun. Later, however, the drift of government wartime employees back to civilian operations, the announced desire of WPB to retire from the scene as soon as practical, and the fact that the reconversion pattern is gradually taking shape almost by itself, combine to alleviate those earlier nightmares of bureaucratic stretchings for power. As matters now stand, it appears that the War Manpower Commission will dominate the transitional reconversion period between the endings of the two wars, permitting returns to civil industry as manpower

situations in specific trades and specific regions loosen up. Behind the offices of the Manpower Commission stand the Area Production Urgency Committees, which include representatives from the WPB, the WMC, and the services, assuring balanced opinion on problems.

As regards legislative activity, the rules by which reconversion must live have been drawn and—while they are not entirely satisfactory in any degree—appear to be a substantial start toward the heart of the problem. Beyond that, on the score of postwar planning, the George Committee of the Senate has offered some rather disregarded and rather important statements of policy whose weight should be considered in any appraisal. This Committee opposes "any action that expands or tends to expand federal authority," it opposes subsidizing of any segment of the economy; it feels there should be sufficient financial differential between employment and unemployment to reduce the latter. On the subject of post-war employment it urges the availability of materials necessary for private construction, repair and maintenance; feels that an Office of Mobilization should be set up to demilitarize the country; suggests the advisability of outmigration of workers from the 335 war boom counties in the United States; indicates that price and rationing controls should be continued only long enough to assure proper distribution of scarce materials and to prevent inflation; urges revision of the tax structure to promote expanding production and consumption; calls for expanding foreign trade by all feasible methods; and recommends stripping down of the government to eliminate overlapping functions.

Reconversion problems bear most heavily on the automobile industry, probably the most thoroughly converted production segment in the country. As an example of its problems and worries, it cites the case history of one company as follows:

"Prewar this facility was highly integrated, including foundry, forge shop, stamping plant, body shop, machining division, and assembly lines, together with facilities for painting, trimming, heat-treating, etc. Today all equipment previously devoted to car production has been moved out or relocated. Only the forge shop, power house and general offices resemble the prewar setup. "Prewar this company had 3900 machine tools. Of these, 2000 were adapted and used on war contract. Another 300 were sold outright. The remainder were moved out-



Are you already in production? If not, how soon do you expect to be?

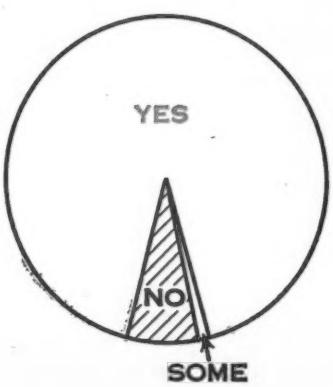
doors; they will have to be overhauled completely for reconditioning.

"Since war began, 8000 government-owned machines were added to the 2000 contractor-owned units. Before reconversion is complete, every one of the 10,000 machines has to be moved. About $20,000,000 worth of government-owned special tools, jigs, fixtures and gages will have to be checked over and disposed of; presumably they will have to be cleaned, oiled, packed and prepared for shipment. Another $1,600,000 in government-owned standard tools — drills, taps, jigs, etc.—will have to be checked and disposed of.

"Also in process when reconversion is authorized will be approximately $56,000,000 worth of parts for two special aviation-type engines—14,000 kinds of parts for one of them, 9000 kinds for the other. Disposition will have to be made of these."

Problems like that one have been throwing their weight about for al-

Are machinery and equipment for the products covered by the spot authorization on hand?



most a year in autos, and in lesser degree in other industries. Noteworthy among the problems involved has been the physical job of plant clearance which must be accomplished preliminary to resumption of normal production when civilian goods output in quantity once more becomes permissible.

Settlement Predetermination

The best solution for this roadblock has come out of the Chicago Ordnance district, where Studebaker Corp., South Bend, Ind., conceived, matured, and saw through to approval a pattern for predetermination of contract settlement. In effect, the plan—first carried out on Studebaker's M-29 "Weasel" cargo carriers—is to complete in advance determinations between the company and the government on inventory disposal, charge-offs of factory and administrative overhead, profit percentage, items to be included as post-termination expenses, and decision of prepayment of part of the claim before final settlement. The procedure worked out by Studebaker with the ordnance district is one which can be followed by virtually any large contractor making a product on a fairly regular schedule. Studebaker anticipates that its system of predetermination will enable it to put the Weasel contract behind it and out of mind within 30 days of notice of cancellation, whether on Victory Day or otherwise. Because the formula is so universally applicable, it deserves analysis here.

The first step, and a big one, is the listing of every raw material and component going into the manufacture of the product at the factory. This material is divided into four categories: (1) materials which to the best of contractor's knowledge and investigation have no value except for scrap; (2) materials the contractor is willing to buy at 75 per cent of cost or better; (3) materials which the contractor offers to buy at less than 75 per cent of cost; (4) material without an immediate apparent market, but which should be stored for disposal through regular channels later.

These breakdowns, of course, are checked by the service command awarding the contract after the contractor has submitted his findings. Dissent may be registered on any item, of course, and the determination then worked out. For instance, a contractor might have (as in the Studebaker predetermination) a quantity of terne plate costing about $15,000. The contractor can use this steel in inventory for civilian production instead of hot-rolled sheet, but natural-

ly would not buy it at more than hot rolled sheet prices. Accordingly, an offering in the third category is made. If the ordnance district figures that the terne plate can be disposed of at full price, it likely would order a transfer to category four; otherwise it would stay where it is.

Actually, of an estimated $1,700,000 productive inventory, Studebaker recommended that $1,100,000 be scrapped. The company offered to buy, for $169,000, inventory costing $294,000, percentages of cost ranging from 30 to 100 per cent. The balance, earmarked for storage and ultimate disposition, consisted of usable and completed goods for which no immediate market was in sight. In every case actual quantities were estimated, being based on the average 30-day supply maintained to feed the assembly lines. Inasmuch as dispositions were worked out in percentages rather than actual dollars, deviation of the estimates from the actual goods on hand is of little moment. It may be said that deviation runs no more than 5 or 10 per cent, according to present indications, amply demonstrating how carefully such programs can be worked out.

Overhead and Profit

Inventory disposal at any time the contract may be terminated having thus been handled, Studebaker next sought to determine factory overhead charges. This was settled on the basis of another contract in process at the plant, on which a factory overhead percentage is figured every 90 days. The next price determination asked for and obtained was a 2 per cent administrative overhead charge, the figure having been derived by audits over the preceding twelve months.

Studebaker also sought and agreed on eight post-termination expense items—cost of taking a physical inventory, of moving inventory, moving scrap, mutilating scrap, preserving parts, packing, loading and shipping them, contract termination division expenses, and insurance. No dollar amounts or percentage amounts were asked for; it was simply determined that reasonable charges could be made on these expenses.

Arrangement was then worked out for the company to obtain the same profit on the claim as on the contract, which amount to 8 per cent on the selling price or 8.7 per cent on total cost. Subsequently, however, Studebaker received an additional contract on which a profit of 6 per cent on selling price or 6.4 per cent on cost was set, and this was applied to the predetermination agreement.

To accomplish this noteworthy objective, Studebaker had not only to blaze a trail of procedure, but also had to get the law changed to permit the blazing of the trail. After discussions with the Office of Contract Settlement, Chicago ordnance and the readjustment division of the Army Service Forces, OCS produced its Termination Regulation No. 3, which authorizes settlements in this manner.

Studebaker is now carrying this procedure farther by contacting the company's 400 primary subcontractors. They have been asked to fill out similar forms and submit them to Studebaker; a considerable number have already done so.

Having undertaken this job on its Weasel contract, Studebaker is now extending it into its 2½-ton truck contract. Although the first job of predetermination took a good two months, it is expected that the second venture will be accomplished in considerably less time, now that the way is known, and that procedure will be further simplified as time goes on.

Probably this development is one of the most noteworthy in a year which has seen a great deal of concentrated attention devoted to the subject of contract cleanup. In one action Studebaker has set up means of disposing of military inventory in its plant, getting it out of the way, getting paid for it, and deciding how overhead charges should be balanced. Industry might well breathe hosannas in the direction of Studebaker's Courtney Johnson, who saw a way to do the job and then saw to it that the job was done.

Labor Problems

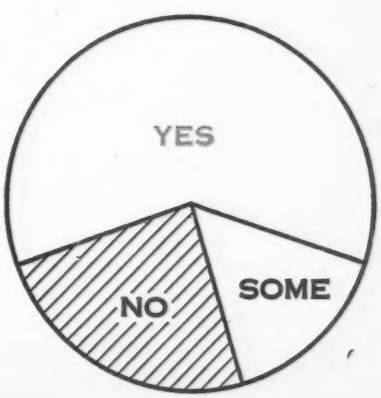
Less matured are solutions to the labor problems expected to be incident to reconversion. If the prophets can be believed, Reconversion Road will be pockmarked with labor trouble. The no-strike pledge of the unions, never too firm during the most recent half of the war period, will likely shake off its foundation when half a plant is on war work and half is on peace-time production; and when complete reconversion arrives, the possibilities for labor disputes — and strikes—over such matters as seniority, wages, hours, integration of veterans into factory jobs, working conditions and others may likely swell to unprecedented proportions. The strike waves of 1919 and 1937 will likely be duplicated.

Probably no better analysis of things ahead has been summarized than appeared in a recent address be-

When unlimited civilian production is authorized, how long do you estimate will be required for you to resume full production?

Is authorized product one you made before the war?

Are materials on hand or readily available from your suppliers? Results exclude returns from mattress manufacturers that show: Yes—7 per cent; No—83 per cent; Some—10 per cent.



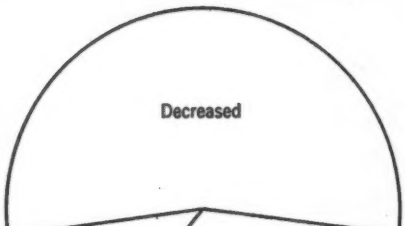
fore the American Management Assn. by Frank Rising, general manager of the Automotive & Aviation Parts Manufacturers, Inc. Maintaining that there are five basic areas of dispute between employers and employees, Rising summarized them and outlined a program for concerted action to eliminate them.

Individual productivity was the first of these. It was maintained that labor principles largely favor standardization of production at an average level, something management disapproves. The second cause for disagreement lies in the area of responsibility and discipline — something manifested quite evidently in the wildcat strikes of the past few years, and something that has grown to the point where the rank and file of many labor unions have no great respect for their own elected leaders. A third problem comes in growing class consciousness; Rising was of the opinion that labor's bitterness against management is increasing, rather than declining, tending to undermine a foundation of mutual necessity and activity basic to continued economic progress. The fourth reason cited was the trend of the unions toward direct political action, as epitomized in CIO-PAC—evidently leading to belief that workers as a class will attempt to achieve special privilege in their encounters with management. The final basic cause of present and postwar disputes between management and labor was set down by Rising in the question, "How far is the union program going to go?" He indicated that as long as management is uncertain as to labor's ultimate aims, it cannot deal with confidence and ease.

Seniority

The path of recent labor troubles foreshadows another primary peg on which labor disputes will be draped—seniority. Recent strikes in labor-nervous Detroit have evolved almost entirely around that issue. As cutbacks loom closer, as supervisors are put back on production jobs, and as the first veterans of this war begin to filter back into the factories, any spark of argument over a place on the employment list can erupt into a quick explosion.

Hanging like a portentous cloud over the labor front is the larger question of who gets the jobs when all the vets return. Of the 11,000,000 men who will be demobilized, a sizable proportion will seek places in industry. Some will have seniority standing accrued from before the war; a great host of others will not have. The unions want to make jobs for all veterans to prove good faith—but the interests of present members bulk important also. Methods for integrating the returned soldiers and sailors into the seniority lists are now the subjects of discussion Washington and Detroit, in Philadelphia and Portland. The human side of the problem is a pressing side.



If production on the spot authorization has started, do you find production per man has changed in comparison with prewar rates?

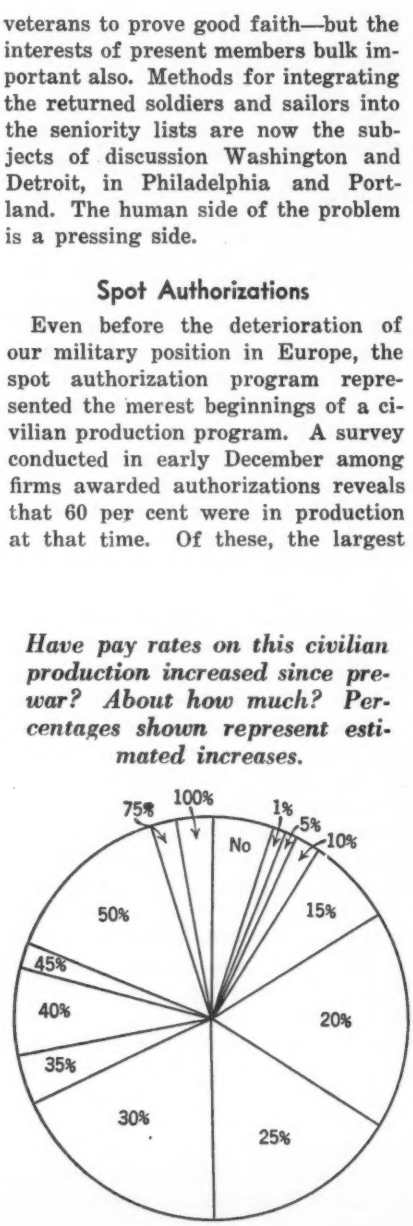
Spot Authorizations

Even before the deterioration of our military position in Europe, the spot authorization program represented the merest beginnings of a civilian production program. A survey conducted in early December among firms awarded authorizations reveals that 60 per cent were in production at that time. Of these, the largest proportion represented insignificant production quantities, or merely the production or assembly of component parts for stockpiling until additional materials and labor are available. The results of the survey indicate the slow progress to be anticipated in the reconversion program when stocks of basic materials like copper, zinc and aluminum had long been building up. Now that these and other materials are being conscripted again for the expanded military program, there is little likelihood of the continuation of many of these manufacturers in civilian production.

Materials were on hand or readily available from suppliers in 60 per cent of the spot authorizations, but many responses indicated that production from limited materials on hand represented the full extent of the authorization. These figures do not include manufacturers of mattresses, bedsprings and sofa beds operating under limitation order L-49, the largest single group to receive authorizations. Only 15 per cent of this group is now in production and this may be attributed to the fact that not more than 7 per cent report materials on hand or readily available from suppliers. Innerspring units are unobtainable because the fine high-carbon steel wire required for these units is not available with a Z-1 priority, although the shortage seems not to apply to wire for coil and box springs.

Cotton ticking is considered by this group to be even more critical.

Have pay rates on this civilian production increased since prewar? About how much? Percentages shown represent estimated increases.



Availability of Materials

Spot authorization appears big when put into print. Actually it does not mean anything to certain industries. Electric motors, for example, are still critical and they are not any more available now than ever. In fact it is reported to be harder to get motors now than a year ago. Industries dependent on this type of equipment for use in or with their product are unable to engage in civilian production despite spot authorizations.

Raw materials not on hand or readily available from suppliers for use in the spot authorization program include steel sheet, strip, tubing and wire, galvanized sheet and enameling stock, copper and brass, iron, steel and non-ferrous castings, steel forgings, lumber and plywood, stainless steel, sheet aluminum and electrical resistance wire. Equipment parts not readily available for civilian production include motors, transformers, meters, ball bearings and hardware.

Machinery and equipment for spot authorized production are reported to be on hand in 92 per cent of the cases.

Approximately half of the remainder indicate that production equipment is obtainable from suppliers or government surpluses.

One of the most significant facts developed by the survey is that only 15 per cent of the spot authorizations represent a product not manufactured before the war. This figure includes new ventures, in some instances returned war veterans who have had no previous experience as entrepreneurs.

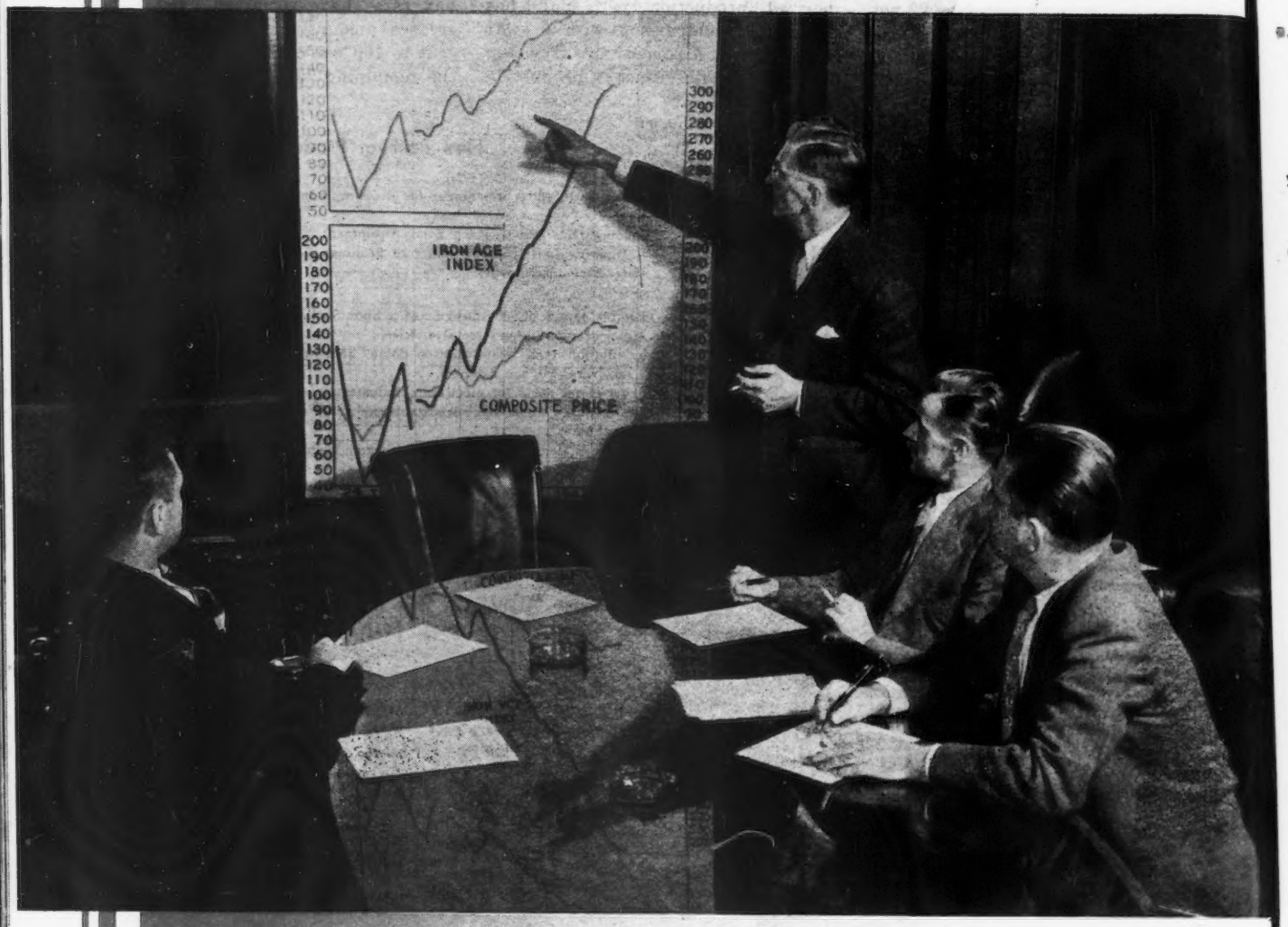
When unlimited civilian production is authorized, it is estimated by 22 per cent of reporting firms that full production can be started immediately. Full production is considered by 18 per cent to be dependent on the availability of materials, and by 13 per cent on the availability of labor. Others indicate the need for a lapse of time varying from a month to a year. These periods probably include an estimate of the time required for accumulations of materials and labor, but also must contemplate time for reconversion of production facilities.

Production Rates

The question whether spot authorized production per man has changed in comparison with prewar rates brought a somewhat surprising response. No difference in production rates was reported in 34 per cent of the cases. Production per man was said to have increased in 12 per cent of reports, and decreased in 54 per cent. The increases were said to have been caused by more efficient utilization of machinery and manpower; the decreases, of course, to transitory, handicapped and over-age workers.

Pay rates on civilian production are said by 5 per cent not to have increased at all. This is attributed by some to the use of union labor whose pay rates have remained fixed. Increases amounting to from one per cent to 100 per cent are estimated by the remaining 95 per cent of returns.

Company	New Postwar Products
M-1-k	
All Electric Steam Iron Mfg. Co. 406 S. Main St., Los Angeles 13.	Steam generating attachment for dressing irons.
M-9-c	
Custom-Craft Mfg. Co. Wakefield, Mass.	Fishing reels and sporting goods equipment.
Simplex Mfg. Co. Fond du Lac, Wis.	Barometric draft controls and roof flashings.
O. M. Franklin Serum Co. 4238 York St., Denver.	Veterinary instruments.
M-126	
Farmor Mfg. Co., Inc. 2862 Gravois St., St. Louis 18.	Electric lamps of new design not a Spot Shell.
Wade Button Co., Inc. 55 Sudbury St., Boston 14.	Metal stampings and metal articles.
Albert H. Voigt 4432 Ridge Ave., Philadelphia 29.	Ventilation fans, glass shower doors, area walls, under ground garbage receivers, kitchen cabinets.
L-13-a	
Corry-Jamestown Mfg. Corp. Corry, Pa.	Sheet metal parts for electronics industry.
Pacific Safe Mfg. Co. 1234 Whipple Ave., Redwood City, Calif.	Desk safes, home safe deposit boxes, and a new production tool for machine shops.
Chrom-O-Lite Co. 2165 Latham St., Memphis, Tenn.	Chrome plated breakfast sets, porch and lawn furniture.
L-18-b	
Martin-Parry Corp. York, Pa.	Rexair cleaners, METLWAL partitions and miscellaneous sheet metal products.
L-29	
Southern Neon Display, Inc. 318 Edgewood Ave., N. E., Atlanta.	Interior lighting.
Bretz Sign Co. 120 S. Second St., Guthrie, Okla.	Cold cathode fluorescent lighting fixtures.
J. F. Zimmerman & Son 3201 Ross Ave., Dallas 1.	
L-30-a	
E. S. Feuill & Son Buffalo, Ky.	Tubs, buckets, coal buckets, stove pipe, wood burning stoves, stove pipe ovens, pie pans, flue stacks, special made sheet iron boxes to specifications.
L-30-d	
D. B. Milliken Co. 2420 N. Lake St., Altadena, Calif.	Bacon racks.
Matt G. Reeves & Co.	Centrifugal pumps, surface irrigation, pipe and food slicing machines.
Novelty Mfg. Co. Lancaster, Pa.	Metal vases for flowers, cake cutters, and contract work on sheet metal.
Hanger Service Co. Yonkers, N. Y.	Wire specialties, plastics.
L-30-e	
Hayward Non-Ferrous Foundry Hayward, Calif.	Cooking utensils, toys, coaster wagons, wheels for coaster wagons.
L-30-e	
Kromex Corp. Cleveland 14.	Aluminum kitchen specialties.
J. M. Harris 6000 Avalon Blvd., Los Angeles.	Aluminum cooking utensils.
J. B. Laubfonf 831 N. 36 Way, Birmingham, Ala.	Aluminum cooking utensils and brass and bronze pipe fittings.
L-33	
Prior Mfg. Co. 4431 Germantown Ave., Philadelphia.	Electrical household products and like metal assemblies.
L-38	
Stoddard Mfg. Co. Mason City, Ia.	Home freezer refrigerators.
L-42	
Eaton Metal Products Co. Denver	Plastic lined tanks, full line of products for liquid petroleum gas industry.
L-49	
Stine Upholstering Co. Hickory, N. C.	Studio beds and office chairs covered with coated fabrics.
Universal Bed Co. Portland, Ore.	Metal furniture.
L-62	
Cut Chrome Co. of America 720 Beacon St., Boston.	Modern kitchen seating.
Standard Electric Mfg. Co. 2020 Richardson St., Dallas 1.	Aluminum ware, gas fired furnaces, building specialties.
L-65	
Atlas Mfg. Co. 9761 Olive St., St. Louis.	Electric and gas commercial cooking equipment for hotels, restaurants and institutions.
L. Gannett Co. 221 E. 1 St., Los Angeles 12.	Electric heaters, fans, hotplates and vaporizers.
L-67	
Sensational Mower, Inc. Ralston, Neb.	Large line of mowers, gas and electric.
Clifford L. Walker P. O. Box 1023, Plant City, Fla.	Electric lawnmowers.
L-73	
Kendall Sealer Co. P. O. Box, East Jaffrey, N. H.	Label moistener.
L-75	
Heating Assurance Co. 124 E. Augusta St., Spokane.	Coal stokers, coal conveyors and sack loaders.
L-91	
Hammond Laundry, Cleaning Machinery & Supply Co., Inc. Waco, Tex.	Open-end drycleaning washer.



War and postwar planning require a statistical approach to the complex problems of production and distribution. Only from a study of the past can the future be formulated.

Prices and Production

The production of metal products has reached astounding peaks during the war but prices have been stabilized. However, open hearth grades of scrap dropped below ceilings near the end of August, after which open market fluctuations have reflected supply and demand.

By John Anthony

THE IRON AGE Price and Production Summary

(As of Jan. 4, 1945)

Subject	Page
Cast iron pipe, prices	121
Coke	
Furnace grade, prices	121
Foundry grade, prices	121
Ferroalloys	
Ferromanganese, prices	170
Ferrosilicon, prices	168
Spiegeleisen, prices	168
Iron Ore	
Shipments	121
Prices	121
Non-ferrous Metals	
Aluminum, prices	172
Copper, prices	170
Lead, prices	172
Magnesium, prices	172
Tin, prices	172
Zinc, prices	170
Pig Iron	
THE IRON AGE composite price	121
U. S. Monthly Production	120
Basic at Valley furnace, prices	152
Lake Superior charcoal iron, prices	148
Malleable at Valley furnace, prices	121
No. 2 fdry, Valley, prices	148
No. 2 foundry at Buffalo, prices	150
No. 2 foundry at Chicago, prices	148
No. 2 foundry at Birmingham, prices	150
No. 2 foundry at Granite City, prices	150
Scrap Iron and Steel	
THE IRON AGE, composite price	164
No. 1 hvy. mlt., Pittsburgh, prices	164
No. 1 hvy. mlt., Chicago, prices	164
No. 1, Eastern Pennsylvania, prices	166
No. 1 cast scrap at Cincinnati, prices	166
No. 1 mch. cast, Chicago, prices	166
Scrap Rails, Pittsburgh, prices	168
Steel	
THE IRON AGE, Composite Price	120
Bars, cold rolled, prices	160
Bars, merchant, prices	162
Ingot production	121
High speed steel	152
Pipe, prices	152
Plates, prices	154
Rails, prices	160
Sheets, cold rolled, prices	154
Sheets, galvanized, prices	158
Sheets, hot rolled, prices	154
Sheets, stainless	152
Strip, cold rolled, prices	158
Strip, hot rolled, prices	158
Structural shapes, prices	162
Tin plate, prices	160
Wire, prices	162

Steel Ingot Production

Open Hearth, Bessemer and Electric Ingots and Steel for Castings—Net Tons

For Data Previous to 1920, See Statistical Supplement, THE IRON AGE, Jan. 4, 1940

Source: American Iron and Steel Institute

	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932
January	3,974,213	2,832,150	2,129,686	4,325,457	4,107,080	4,719,919	4,656,029	4,302,172	4,531,172	5,115,195	4,288,212	2,852,540	1,685,685
February	3,838,328	2,248,923	2,332,217	3,909,643	4,306,501	4,223,613	4,264,863	4,327,341	4,590,842	4,920,348	4,579,761	2,892,154	1,681,421
March	4,417,344	2,019,465	3,168,503	4,579,489	4,733,607	4,721,111	5,035,081	5,148,330	5,117,394	5,760,878	4,828,571	3,468,208	1,627,030
April	3,532,623	1,560,522	3,267,086	4,463,584	3,767,877	4,033,752	4,626,271	4,685,249	4,868,226	5,628,810	4,664,182	3,141,887	1,429,848
May	3,860,482	1,627,229	3,623,434	4,748,038	2,970,710	3,888,883	4,425,910	4,594,340	4,776,766	6,008,754	4,520,520	2,897,385	1,277,302
June	3,991,068	1,289,861	3,520,973	4,242,308	2,324,411	3,606,900	4,207,512	3,968,129	4,250,736	5,573,076	3,879,960	2,416,078	1,036,102
July	3,752,903	1,032,726	3,324,009	3,976,776	2,112,991	3,471,854	4,095,783	3,637,255	4,320,783	5,513,548	3,316,654	2,143,351	915,738
August	4,017,502	1,462,971	2,958,784	4,161,827	2,872,652	3,850,644	4,492,374	3,971,467	4,744,291	5,614,144	3,473,898	1,949,462	961,153
September	4,016,322	1,510,108	3,172,549	3,780,066	3,181,798	3,927,822	4,409,463	3,710,754	4,709,416	5,148,744	3,223,766	1,754,817	1,125,892
October	4,038,323	2,078,382	3,838,975	4,028,163	3,516,891	4,377,214	4,591,053	3,764,573	5,279,480	5,154,063	3,055,972	1,805,653	1,233,957
November	3,533,112	2,133,903	3,861,539	3,529,560	3,512,087	4,393,068	4,175,502	3,549,711	4,844,460	4,002,385	2,510,820	1,807,315	1,171,710
December	3,133,690	1,834,504	3,715,317	3,224,324	4,016,316	4,469,629	3,906,230	3,604,731	4,562,175	3,299,788	2,246,742	1,477,529	977,389
Total	46,103,910	21,630,744	38,914,072	48,969,215	41,421,921	49,684,409	52,886,071	49,264,052	56,815,711	61,735,509	44,589,058	28,606,379	15,123,207

	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944
January	1,157,745	2,276,596	3,279,411	3,474,353	5,398,326	1,984,815	3,663,004	5,764,723	6,928,085	7,112,106	7,424,522	7,588,740
February	1,221,664	2,521,472	3,169,849	3,379,587	5,050,824	1,942,795	3,448,120	4,525,797	6,237,900	6,512,535	6,824,604	7,188,317
March	1,022,675	3,190,040	3,273,848	3,810,436	5,970,247	2,293,884	3,929,387	4,389,183	7,131,641	7,392,111	7,674,578	7,820,226
April	1,531,813	3,346,922	3,017,120	4,494,782	5,801,540	2,196,413	3,431,600	4,100,474	6,756,949	7,121,291	7,373,703	7,588,023
May	2,250,236	3,875,202	3,009,189	4,614,529	5,894,260	2,061,169	3,372,636	4,967,782	7,053,238	7,382,578	7,549,691	7,696,655
June	2,919,687	3,487,612	2,580,723	4,543,888	4,787,710	1,868,848	3,606,729	5,657,443	6,800,730	7,015,302	7,039,353	7,228,835
July	3,607,288	1,697,879	2,591,191	4,473,940	5,212,832	2,259,677	3,648,639	5,724,625	6,821,682	7,144,958	7,407,876	7,493,083
August	3,260,279	1,574,649	3,331,707	4,782,442	5,580,683	2,903,805	4,341,726	6,186,383	7,000,957	7,227,855	7,586,464	7,493,430
September	2,599,370	1,446,551	3,227,815	4,744,841	4,907,592	3,029,736	4,881,601	6,056,248	6,819,706	7,057,519	7,514,339	7,229,892
October	2,373,729	1,689,272	3,590,878	5,182,430	3,881,819	3,554,912	6,223,126	6,644,542	7,242,683	7,579,514	7,814,117	7,578,304
November	1,731,930	1,836,008	3,599,619	4,941,014	2,464,793	4,072,676	6,292,322	6,469,107	6,969,987	7,179,812	7,371,975	7,258,534
December	2,047,780	2,239,126	3,511,636	5,056,843	1,685,273	3,583,253	5,958,893	6,495,357	7,163,999	7,304,540	7,255,144	7,300,712
Total	25,724,196	29,181,329	38,182,986	53,449,085	56,635,899	31,751,983	52,797,783	66,981,662	82,927,557	86,029,921	88,836,366	89,500,000

* December estimated.

United States Pig Iron Production

(Thousands of net tons; includes ferroalloys made in blast furnaces, but excluding charcoal iron)

Source: 1901 *to* 1942, *THE IRON AGE, October* 1942 *to* 1944, *A.I.S.I.*

	Jan.	Feb.	Mar.	April	May	June	First Half	July	Aug.	Sept.	Oct.	Nov.	Dec.	Second Half	Year
1901	1301	1270	1433	1408	1500	1476	8,388	1523	1496	1456	1548	1526	1418	8,967	17,355
1902	1599	1409	1618	1652	1728	1621	9,627	1615	1644	1589	1659	1605	1722	9,834	19,461
1903	1649	1558	1668	1801	1920	1874	10,470	1732	1760	1741	1596	1163	949	8,941	19,411
1904	1035	1353	1625	1748	1721	1452	8,934	1256	1314	1521	1630	1664	1810	9,195	18,129
1905	1996	1789	2168	2153	2200	2007	12,313	1951	2065	2127	2299	2256	2292	12,990	25,303
1906	2317	2133	2425	2323	2349	2214	13,761	2255	2158	2208	2461	2450	2503	14,035	27,796
1907	2471	2290	2493	2485	2571	2503	14,813	2527	2520	2446	2506	2047	1382	13,428	28,241
1908	1171	1207	1375	1288	1306	1223	7,570	1364	1523	1589	1756	1767	1950	9,949	17,519
1909	2014	1912	2056	1948	2109	2162	12,201	2355	2519	2671	2912	2853	2952	16,262	28,463
1910	2922	2685	2932	2782	2677	2537	16,535	2407	2360	2303	2344	2139	1991	13,544	30,079
1911	1971	2011	2433	2314	2121	2004	12,854	2008	2158	2214	2355	2240	2288	13,263	26,117
1912	2305	2352	2694	2660	2815	2734	15,560	2700	2813	2760	3013	2947	3116	17,349	32,909
1913	3130	2896	3096	3083	3161	2945	18,311	2867	2852	2807	2852	2501	2222	16,101	34,412
1914	2111	2115	2630	2542	2344	2148	13,890	2193	2234	2109	1992	1700	1698	11,926	25,816
1915	1793	1887	2312	2370	2535	2667	13,564	2871	3114	3195	3501	3401	3587	19,669	33,233
1916	3567	3458	3740	3614	3764	3596	21,739	3611	3589	3586	3930	3710	3559	21,985	43,724
1917	3529	2963	3642	3735	3827	3662	21,358	3743	3638	3510	3699	3591	3229	21,410	42,768
1918	2701	2596	3599	3683	3861	3723	20,163	3832	3796	3828	3904	3757	3846	22,963	43,126
1919	3699	3293	3461	2775	2361	2369	17,958	2721	3072	2787	2087	2679	2949	16,295	34,253
1920	3377	3337	3781	3068	3344	3409	20,316	3435	3525	3504	3688	3287	3029	20,468	40,784
1921	2705	2169	1788	1336	1368	1193	10,559	969	1069	1104	1396	1585	1847	7,970	18,529
1922	1842	1826	2280	2321	2583	2644	13,496	2694	2034	2278	2956	3191	3457	16,610	30,106
1923	3617	3353	3947	3976	4332	4117	23,342	4119	3864	3501	3527	3241	3272	21,524	44,866
1924	3382	3441	3883	3622	2929	2269	19,526	1999	2114	2299	2774	2811	3318	15,315	34,841
1925	3774	3600	3992	3650	3283	2995	21,294	2984	3030	3052	3386	3386	3640	19,478	40,772
1926	3714	3274	3855	3864	3900	3623	22,230	3610	3586	3512	3734	3626	3461	21,529	43,759
1927	3477	3294	3901	3832	3798	3461	21,763	3305	3300	3108	3118	2966	3020	18,817	40,580
1928	3214	3248	3585	3567	3678	3452	20,744	3441	3514	3429	3779	3698	3774	21,635	42,379
1929	3855	3591	4160	4102	4366	4163	24,237	4239	4218	3918	4019	3563	3177	23,133	47,360
1930	3166	3180	3636	3564	3620	3286	20,452	2956	2827	2550	2425	2092	1866	14,716	35,168
1931	1920	1912	2276	2261	2233	1836	12,438	1639	1435	1309	1314	1235	1098	8,030	20,468
1932	1089	1080	1084	954	877	704	5,788	640	582	663	721	707	612	3,925	9,713
1933	637	621	607	699	993	1417	4,974	2007	2053	1705	1519	1215	1323	9,822	14,796
1934	1361	1416	1813	1934	2288	2162	10,974	1372	1181	1006	1065	1072	1151	6,847	17,821
1935	1654	1802	1983	1863	1934	1739	10,975	1702	1972	1990	2215	2315	2360	12,554	23,529
1936	2269	2042	2285	2693	2966	2896	15,151	2905	3037	3058	3351	3301	3489	19,141	34,292
1937	3597	3359	3875	3799	3961	3481	22,072	3919	4039	3819	3239	2248	1669	18,933	41,005
1938	1601	1454	1627	1541	1406	1189	8,818	1346	1673	1882	2298	2543	2476	12,218	21,036
1939	2436	2307	2682	2303	1924	2373	14,025	2639	2979	3224	4063	4167	4220	21,292	35,317
1940	4032	3311	3270	3137	3514	3819	21,083	4054	4238	4177	4446	4403	4548	25,866	46,949
1941	4664	4198	4704	4334	4600	4553	27,053	4771	4791	4717	4856	4703	5012	28,850	55,903
1942	4971	4500	5055	4896	5073	4935	29,430	5051	5009	4937	5237	4966	5201	30,552	59,982
1943	5137	4766	5314	5035	5178	4836	30,343	5023	5316	5226	5324	5096	5213	31,434	61,777
1944	5283	5091	5442	5251	5351	5064	31,482	5157	5210	4988	5200	4904	*5100	*30,559	*62,041

*Estimate

Finished Steel Composite Price, Cents Per Pound

Source: THE IRON AGE

• • • **Weighted average of** THE IRON AGE quotations on following steel items: Hot rolled and cold rolled strip, bars, plates, shapes, hot rolled and cold rolled sheets, wire, rails and pipe. The composite was revised in 1941 to obtain greater sensitivity in reflecting price changes. This revision was described in detail in issue of Aug. 28, 1941, p. 92. Averages on the old basis for previous years were published in the Annual Statistical Supplement, Jan. 4, 1940. The 1944 composite price has been revised to a quarterly basis.

	1929	1932	1933	1934	1935	1936	1937	1938	1939	1940	1943	1944
January	2.27758	1.851549	1.83017	1.95757	2.06492	2.07642	2.32263	2.58414	2.35367	2.30467	1942	2.27235
February	2.27758	1.842512	1.81151	1.95757	2.06492	2.06513	2.32263	2.58084	2.35367	2.30467	1941	2.27235
March	2.27623	1.852212	1.80821	1.95757	2.06492	2.05463	2.53185	2.57754	2.35367	2.30467	composite	2.27235
April	2.30373	1.891812	1.77951	2.00659	2.06492	2.06220	2.58414	2.57754	2.35367	2.26651	price	2.30329
May	2.30723	1.890912	1.76994	2.15367	2.06492	2.06220	2.58414	2.56939	2.30807	2.30467	fixed	2.30329
June	2.31773	1.888112	1.78578	2.15367	2.06492	2.06680	2.58414	2.51300	2.28297	2.30467	at	2.30329
July	2.31213	1.891962	1.84089	2.10667	2.06492	2.13890	2.58414	2.35944	2.28297	2.30467	2.30467	2.30837
August	2.29423	1.889002	1.85084	2.06492	2.06492	2.13890	2.58414	2.35944	2.28297	2.30467		2.30837
September	2.28225	1.88308	1.87877	2.06492	2.06492	2.14554	2.58414	2.35655	2.28297	2.30467		2.30837
October	2.26950	1.87324	1.95473	2.06492	2.07642	2.17210	2.58414	2.31964	2.28297	2.30467		2.30837
November	2.26498	1.86553	1.94737	2.06492	2.07642	2.17210	2.58414	2.35367	2.28837	2.30467		2.30837
December	2.27750	1.86053	1.95757	2.06492	2.07642	2.26276	2.58414	2.35367	2.30467	2.30467		2.30837
Average	2.28839	1.87337	1.85127	2.05149	2.06779	2.11814	2.53620	2.45874	2.31088	2.27287		2.29809

Furnace Coke, Prompt Connellsville, Net Ton at Oven

	1933	1934	1935	1936	1937	1938
January	$1.75	$3.60	$3.85	$3.65	$4.00	$4.00
February	1.75	3.50	3.85	3.65	4.06	4.00
March	1.75	3.50	3.85	3.65	4.25	4.00
April	1.75	3.85	3.85	3.65	4.51	4.00
May	1.75	3.85	3.85	3.65	4.60	4.00
June	1.81	3.85	3.59	3.65	4.58	3.85
July	2.31	3.85	3.27	3.50	4.35	3.75
August	2.55	3.85	3.29	3.61	4.35	3.75
September	2.50	3.85	3.25	3.69	4.27	3.75
October	3.50	3.85	3.53	3.75	4.25	3.75
November	3.75	3.85	3.60	3.75	4.25	3.75
December	3.75	3.85	3.57	3.92	4.00	3.75
Average	2.41	3.79	3.61	3.68	4.29	3.86

	1939	1940	1941	1942	1943	1944
January	$3.75	$4.20	$5.50	$6.13	$6.00	$7.00
February	3.75	4.00	5.50	6.00	6.25	7.00
March	3.75	4.00	5.52	6.00	6.50	7.00
April	3.75	4.00	5.63	6.00	6.50	7.00
May	3.75	4.00	6.00	6.00	6.50	7.00
June	3.75	4.00	6.13	6.00	6.50	7.00
July	3.75	4.20	6.13	6.00	6.50	7.00
August	3.75	4.63	6.13	6.00	6.50	7.00
September	4.25	4.75	6.13	6.00	6.50	7.00
October	4.90	4.75	6.13	6.00	6.50	7.00
November	5.00	5.10	6.13	6.00	6.50	7.00
December	5.00	5.375	6.13	6.00	6.50	7.00
Average	4.09	4.42	5.92	6.01	6.45	7.00

Foundry Coke, Prompt Connellsville, Net Ton at Oven

	1933	1934	1935	1936	1937	1938
January	$2.50	$4.25	$4.60	$4.25	$4.50	$5.00
February	2.50	4.25	4.60	4.25	4.50	5.00
March	2.50	4.25	4.60	4.25	4.50	5.00
April	2.50	4.60	4.60	4.25	5.00	5.00
May	2.50	4.60	4.60	4.25	5.25	5.00
June	2.58	4.60	4.15	4.25	5.25	4.85
July	2.94	4.60	3.88	4.00	5.00	4.75
August	3.15	4.60	4.00	4.00	5.00	4.75
September	3.25	4.60	4.00	4.05	5.00	4.75
October	4.05	4.60	4.20	4.25	5.00	4.75
November	4.25	4.60	4.25	4.25	5.00	4.75
December	4.25	4.60	4.15	4.40	5.00	4.75
Average	3.08	4.51	4.30	4.20	4.92	4.86

	1939	1940	1941	1942	1943	1944
January	$4.75	$5.50	$5.75	$6.88	$6.88	$8.06
February	4.75	5.31	5.75	6.88	7.13	8.25
March	4.75	5.25	5.85	6.88	7.38	8.25
April	4.75	5.25	5.62	6.88	7.38	8.25
May	4.75	5.25	6.72	6.88	7.44	8.25
June	4.75	5.25	6.88	6.88	7.50	8.25
July	4.75	5.25	6.88	6.88	7.50	8.25
August	4.75	5.25	6.88	6.88	7.50	8.25
September	5.12	5.25	6.88	6.88	7.50	8.25
October	5.65	5.25	6.88	6.88	7.50	8.25
November	5.75	5.625	6.88	6.88	7.50	8.25
December	5.75	5.75	6.88	6.88	7.50	8.25
Average	5.02	5.35	6.49	6.88	7.39	8.24

Cast Iron Pipe at New York, Net Ton

6-in. and Larger

	1929	1930	1931	1932	1933	1934
January	$39.60	$36.10	$37.90	$30.20	$35.20	$43.00
February	39.35	38.60	37.90	29.70	35.30	43.00
March	38.60	38.75	37.90	28.40	35.30	43.00
April	37.40	39.50	35.40	28.20	35.30	43.00
May	35.85	39.90	34.15	28.20	35.30	43.00
June	35.10	39.90	33.70	28.20	38.30	44.00
July	33.20	39.30	32.90	28.73	38.30	45.00
August	33.60	38.90	32.90	31.10	38.30	45.00
September	33.60	38.90	32.90	31.30	38.30	45.00
October	34.60	38.90	32.90	33.30	38.00	45.00
November	34.60	38.65	32.90	33.30	43.00	45.00
December	34.60	37.90	32.50	34.30	43.00	45.00
Average	35.84	38.78	34.50	30.41	37.81	44.08

	1935	1936	1937	1938	1939	
January	$45.00	$45.20	$48.00	$53.00	$49.00	1944
February	45.00	45.20	48.00	53.00	49.00	1943
March	45.00	45.20	51.00	53.00	49.00	1942
April	45.00	45.20	53.00	53.00	49.00	1941
May	45.00	45.20	53.00	53.00	49.00	1940
June	45.15	45.20	53.00	52.20	49.00	price
July	45.20	45.90	53.00	49.00	49.00	fixed
August	45.20	45.90	53.00	49.00	49.00	at
September	45.20	45.90	53.00	49.00	49.00	$52.20
October	45.20	45.90	53.00	49.00	52.20	
November	45.20	45.90	53.00	49.00	52.20	
December	45.20	47.90	53.00	49.00	52.20	
Average	45.11	45.71	52.00	50.93	49.80	

Prices do not reflect the 3% freight tax.

Steel Ingot Production

Per Cent of Capacity

Source: American Iron and Steel Institute

	1926	1927	1928	1929	1931	1932
January	87.09	77.94	80.33	86.56	44.59	25.88
February	88.35	88.82	87.09	92.21	50.07	26.62
March	94.18	93.27	90.73	97.48	54.21	24.98
April	89.36	87.65	89.49	98.32	50.71	22.67
May	82.79	83.23	84.69	101.68	45.29	19.81
June	81.27	74.24	77.82	97.38	39.00	16.42
July	76.78	66.04	76.78	93.51	33.58	14.09
August	84.03	71.95	84.11	95.00	30.47	14.76
September	85.37	69.58	86.42	90.14	28.39	17.89
October	85.88	68.20	93.60	87.22	28.22	18.94
November	80.65	66.41	88.69	69.94	29.17	18.57
December	73.23	65.45	81.07	55.96	23.15	15.04
Average	84.05	75.83	85.05	88.76	37.99	19.67

	1933	1934	1935	1936	1937	1938
January	17.76	34.32	49.21	52.46	81.32	29.14
February	20.75	42.10	52.68	54.81	84.26	31.59
March	15.68	48.09	49.12	57.54	89.93	33.67
April	24.26	52.10	46.75	70.09	90.24	33.70
May	34.51	58.42	45.15	69.68	88.79	30.26
June	46.24	54.29	39.99	70.85	74.47	28.33
July	55.45	25.65	38.97	67.71	78.37	33.25
August	50.00	23.74	49.99	72.22	83.71	42.63
September	41.26	22.57	50.13	74.16	76.19	46.03
October	36.40	25.46	53.88	78.26	58.23	52.19
November	27.43	28.58	55.77	77.05	38.18	61.74
December	31.48	33.83	52.81	76.53	25.34	52.72
Average	33.52	37.37	48.68	68.45	72.33	39.60

	1939	1940	1941	1942	1943	1944
January	52.69	83.40	96.90	94.5	96.8	95.6
February	54.93	70.00	96.60	95.9	98.5	96.9
March	56.52	63.50	99.70	98.2	100.0	98.5
April	50.97	61.20	97.60	97.7	99.3	98.5
May	48.51	71.80	98.70	98.1	98.4	96.8
June	53.57	84.50	98.20	96.3	94.8	93.9
July	52.60	83.00	93.40	94.5	96.2	94.4
August	62.45	89.50	95.70	95.4	98.3	94.1
September	72.68	90.60	96.40	96.4	100.7	93.4
October	89.52	96.10	99.00	100.0	101.2	95.1
November	93.46	96.60	98.30	97.8	98.6	....
December	85.91	94.10	98.10	96.8	94.2	....
Average	64.53	82.10	97.40	96.8	98.1	*....

* Eleven months average.

Composite Pig Iron Price

Average of THE IRON AGE quotations on basic pig iron at Valley furnace and foundry iron at Chicago, Birmingham, Buffalo, Valley and Philadelphia, quoted in gross tons.

	1925	1926	1927	1928	1929	1930
January	$22.44	$21.79	$19.44	$17.63	$18.43	$18.19
February	22.50	21.77	19.07	17.73	18.38	18.02
March	21.99	21.65	19.03	17.73	18.36	17.75
April	20.95	20.96	19.21	17.67	18.52	17.73
May	19.85	20.69	19.09	17.45	18.70	17.60
June	19.22	20.00	18.92	17.23	18.65	17.48
July	18.96	19.51	18.56	17.10	18.48	17.16
August	19.01	19.46	18.17	17.11	18.39	16.90
September	19.39	19.46	18.03	17.54	18.27	16.70
October	19.92	19.69	17.96	17.94	18.33	16.31
November	21.16	20.13	17.59	18.46	18.38	16.21
December	21.54	19.94	17.55	18.51	18.24	15.95
Average	20.58	20.42	18.55	17.68	18.43	17.17

	1931	1932	1933	1934	1935	1936
January	$15.90	$14.68	$13.56	$16.90	$17.90	$18.84
February	15.80	14.51	13.56	16.90	17.90	18.84
March	15.71	14.45	13.56	16.90	17.90	18.84
April	15.79	14.35	13.76	17.07	17.90	18.84
May	15.76	14.12	14.48	17.90	17.85	18.84
June	15.62	14.01	15.01	17.90	17.84	18.84
July	15.58	13.76	15.50	17.90	17.84	18.84
August	15.51	13.69	16.09	17.90	17.84	18.73
September	15.44	13.64	16.71	17.90	17.84	18.73
October	15.21	13.63	16.61	17.90	17.87	18.73
November	14.97	13.59	16.61	17.90	18.84	18.98
December	14.88	13.56	16.90	17.90	18.84	19.73
Average	15.51	14.00	15.20	17.58	18.03	18.90

	1937	1938	1939	1940	1941	
January	$20.25	$23.25	$20.61	$22.61	$23.45	1944
February	20.50	23.25	20.61	22.61	23.45	1943
March	22.85	23.25	20.61	22.61	23.53	1942
April	23.25	23.25	20.61	22.61	23.61	price
May	23.25	23.25	20.61	22.61	23.61	fixed
June	23.25	22.98	20.61	22.61	23.61	at
July	23.25	19.61	20.61	22.61	23.61	$23.62
August	23.25	19.61	20.61	22.61	23.61	
September	23.25	19.82	21.61	22.61	23.61	
October	23.25	20.57	22.61	22.61	23.61	
November	23.25	20.61	22.61	22.61	23.61	
December	23.25	20.61	22.61	22.95	23.61	
Average	22.74	21.67	21.19	22.64	23.58	

Lake Superior Iron Ores, Per Gross Ton, at Lake Erie Ports

Bessemer Ores

	Analysis Guarantee		Price	
	Iron Natural	Phosphorus Dry	Old Range	Mesaba
1914	55.00	0.045	$3.75	$3.50
1915	55.00	0.045	3.75	3.45
1916	55.00	0.045	4.45	4.20
1917	55.00	0.045	5.95	5.70
1918 to July 1	55.00	0.045	5.95	5.70
1918–July 1 to Sept. 30	55.00	0.045	6.40	6.15
1918–Oct. 1 to Close	55.00	0.045	6.65	6.40
1919	55.00	0.045	6.45	6.20
1920	55.00	0.045	7.45	7.20
1921	55.00	0.045	6.45	6.20
1922	55.00	0.045	5.95	5.70
1923	55.00	0.045	6.45	6.20
1924	55.00	0.045	4.85	4.60
1925 through 1928	51.50	0.045	4.55	4.40
1929 through 1936	51.50	0.045	4.80	4.65
1937 to April 15, 1940	51.50	0.045	5.25	5.10
1940–April 16 to Close	51.50	0.045	4.75	4.80
1941	51.50	0.045	4.75	4.60
1942	51.50	0.045	4.75	4.60
1943	51.50	0.045	4.75	4.60
1944	51.50	0.045	4.75	4.60

Non-Bessemer Ores

	Analysis Guarantee	Price		
	Iron Natural	Old Range	Mesaba	High Phosphorus
1914	51.50	$3.00	$2.85	....
1915	51.50	3.00	2.80	....
1916	51.50	3.70	3.55	....
1917	51.50	5.20	5.05	....
1918 to July 1	51.50	5.20	5.05	....
1918–July 1 to Sept. 30	51.50	5.65	5.50	....
1918–Oct. 1 to Close	51.50	5.90	5.75	....
1919	51.50	5.70	5.55	$5.35
1920	51.50	6.70	6.55	6.35
1921	51.50	5.70	5.55	5.35
1922	51.50	5.20	5.05	4.85
1923	51.50	5.70	5.55	5.35
1924	51.50	4.90	4.75	4.55
1925 through 1928	51.50	4.40	4.25	4.15
1929 through 1936	51.50	4.65	4.50	4.40
1937 to April 15, 1940	51.50	5.10	4.95	4.85
1940–April 16 to Close	51.50	4.60	4.45	4.35
1941	51.50	4.60	4.45	4.35
1942	51.50	4.60	4.45	4.35
1943	51.50	4.60	4.45	4.35
1944	51.50	4.60	4.45	4.35

Lake Superior Iron Ore Shipments Water Movement, Gross Tons

1929	1932	1933	1934
85,204,600	3,567,985	21,623,898	22,249,600
1935	1936	1937	1938
28,362,368	44,822,023	62,598,836	19,263,011
1939	1940	1941	1942
45,072,725	63,712,982	80,116,360	92,028,325
	1943	1944	
	84,533,434	81,170,538	

Malleable Pig Iron at Mahoning or Shenango Valley Furnace, Gross Ton

	1929	1931	1932	1933	1934	1935
January	$18.00	$17.50	$16.00	$14.50	$17.50	$18.50
February	18.00	17.25	15.62	14.50	17.50	18.50
March	18.25	17.00	15.50	14.50	17.50	18.50
April	18.50	17.00	15.50	14.50	17.75	18.50
May	19.00	17.00	15.20	14.70	18.50	18.50
June	19.00	17.00	15.00	15.50	18.50	18.50
July	19.00	17.00	14.50	16.00	18.50	18.50
August	19.00	17.00	14.50	16.70	18.50	18.50
September	19.00	17.00	14.50	17.50	18.50	18.50
October	19.00	16.88	14.50	17.50	18.50	18.50
November	19.00	16.50	14.50	17.50	18.50	19.50
December	19.00	16.20	14.50	17.50	18.50	19.50
Average	18.73	16.94	14.98	15.91	18.19	18.67

	936	1937	1938	1939	1940	
January	$19.50	$21.00	$24.00	$21.00	$23.00	1944
February	19.50	21.25	24.00	21.00	23.00	1943
March	19.50	23.60	24.00	21.00	23.00	1942
April	19.50	24.00	24.00	21.00	23.00	1941
May	19.50	24.00	24.00	21.00	23.00	price
June	19.50	24.00	23.00	21.00	23.00	fixed
July	19.50	24.00	20.00	21.00	23.00	at
August	19.50	24.00	20.00	21.00	23.00	$24.00
September	19.50	24.00	20.25	22.00	23.00	
October	19.50	24.00	21.00	23.00	23.00	
November	19.75	24.00	21.00	23.00	23.00	
December	20.50	24.00	21.00	23.00	23.50	
Average	19.60	23.49	22.20	21.59	23.04	

(CONTINUED ON PAGE 148)

WLB Liberalizes Wage Increase Rules For Foundries and Forges

Washington

• • • Because it has been contended that the level of wages in foundries and forge shops has been a contributing factor in manpower shortages, WLB has announced that it will approve or grant average wage increases up to 10c. per hr. above the established approvable rate in voluntary or dispute cases on the blanket certification list unless there are compelling reasons making such action inappropriate. This action was set forth in a resolution. The resolution provides that wage cases of critical foundries and forge shops on a special "blue ribbon," "blanket certification list" prepared by WPB and WMC will be handled as "rare and unusual" cases in order to meet critical foundry production problems resulting from manpower shortages in the industry. The resolution followed a board investigation, requested by WPB, WMC and the armed services, into the relationship of minimum wage brackets and foundries to related industries, the current status of cases before the National and Regional War Labor Boards.

WPB will place a foundry on the blanket certification list if:

"The particular foundry is of critical importance to the war effort; production in the foundry is seriously behind war requirements; manpower, rather than materials or any other production factor, is the critical or limiting factor; and the entire or major part of the output of the foundry consists of products of urgent military importance and use."

In joining WPB in placing the name on the list WMC will certify the following:

"The particular foundry has failed to meet production requirements due to a manpower shortage which the WMC has been unable to overcome through its own programs; in the judgment of WMC, in the light of the circumstances, a wage adjustment is certified as an attempt to alleviate the manpower shortage; if any wage adjustment granted to the particular foundry should attract workers from essential industry, WMC believes that the situation is so critical that it approves such a transfer of workers."

For any case on the blanket list, the Wage Stabilization Division of the National Board will incorporate in its analysis a statement from the Regional Board indicating whether or not approving or granting such an above-minimum wage bracket adjustment would be likely to unstabilize foundry or forge shop wage rates in the area in which the particular foundry is located.

All cases involving foundries, including those subject to Regional Boards and not on the special list handled by the National Board are to continue to be given preference in processing and to be processed with the greatest possible dispatch, as directed in the resolution on the processing of foundry cases adopted by the National Board on July 19, 1944.

War Production And Expenses in Canada Showed Slight Drop

Toronto

• • • While Canadian war production for 1944 showed a decline in a number of items from the high record of the previous year, the overall expenditure on war account was down only 3 per cent from the high record made in 1943. During 1944 expenditures on miscellaneous military stores, clothing, personal equipment, foodstuffs, fuel, etc., totalled $464,000,000 a decline of 11 per cent from the $521,000,000 expended in 1943; mechanical transport output valued at $451,000,000 was up 5 per cent from the $429,000,000 of last year; cargo and naval vessels, including repairs, showed an outlay of $409,000,000, which is 3 per cent under the $421,000,000 of the previous year; aircraft output, including overhaul, was valued at $394,000,000, 7 per cent above the $368,000,000 of last year; instruments and signals at $215,000,000, jumped 32 per cent from $164,000,000; gun ammunition, including bombs, at $171,000,000, fell 11 per cent from $193,000,000; armoured fighting vehicles, including tanks, at $159,000,000, fell 27 per cent from $218,000,000; chemicals and explosives, including filling at $158,000,000, rose 5 per cent from the $151,000,000 of last year; guns and small arms at $156,000,000, dropped 21.5 per cent from the $199,000,000 a year ago, and small arms ammunition, valued at $82,000,000, was up 11 per cent from the $74,000,000 of the previous year.

With regard to actual output of war equipment, the only gains registered in the year were in empty shell cases for export service aircraft and in the value of instruments and communication equipment. Regarding production the number of service aircraft turned out in Canadian plants in 1944 is estimated at 4200 compares with 4133 in 1943; mechanical transport 151,100 against 175,000 in 1943; armoured vehicles and tanks, 15,000 against 15,500; locomotives for export, 110 against 41; railway cars for export, 1150 against 1521; guns, mountings and barrels, 24,000 against 45,000; small arms, including machine guns, 495,000 against 580,000; small arms ammunition, 1,000,000,000 against 1,500,000,000; shells and heavy ammunition;—(a) complete rounds filled, 29,700,000 against 30,000,000, (b) empty cases for export, 40,700,000 against 18,300,000, (c) empty shells for export, 550,000 against 887,000; chemicals and explosives, 412,000 tons against 500,000 tons; cargo vessels, 119 against 150; naval vessels and patrol boats, 100, which is the same as in the previous year, while instruments and communication equipment at $215,000,000, compares with $164,000,000 for 1943.

While there were indications of curtailed production in a number of war materials made in Canada in 1944, there was a definite upturn in the output of heavy artillery shells and explosives in the closing weeks of the year and according to announcements from government circles there will be even greater expansion in shell production in the early part of 1945 chiefly due to the release by the United States of big orders to Canadian plants. These new orders run into many millions of dollars and involve small arms ammunition, heavy ammunition cases, mortar shells and other urgently needed war supplies to meet the new demand that has arisen in Europe. This new outpouring of orders will bring the two big government-owned brass rolling mills at Toronto and Montreal back to capacity operations, whereas these plants were expected to close down shortly due to cancellation of United Kingdom's contracts. The new program calls for the greatest output of explosives and heavy ammunition in Canada's history.

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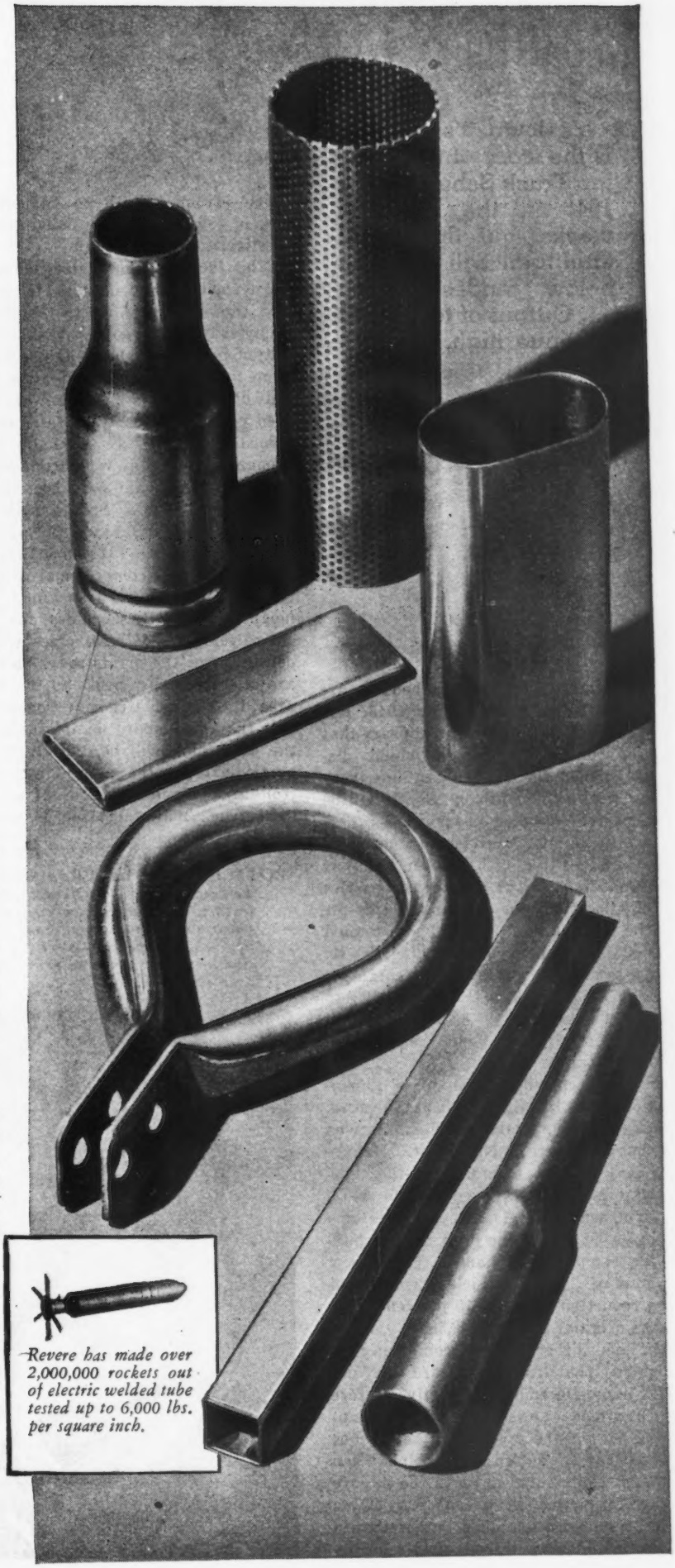

These shapes are just a few of the thousands that have been made of Revere Electric Welded Steel Tube. It is so workable that a great number of parts and products can be made of it. Here are some of the operations customarily performed on these tubes:

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Flange	*Flatten*
Bend	*Taper*
Bead	*Swage*
Machine	*Grind*

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We not only supply steel tube in straight lengths, but also fabricate it into parts that will fit into your assembly with little or no additional processing. One customer reports saving $9 per unit when he switched to Revere Electric Welded Steel Tube. For further information write the Revere Executive Offices.

Revere has made over 2,000,000 rockets out of electric welded tube tested up to 6,000 lbs. per square inch.

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STANLEY H. BRAMS

• It's down, it's up—that is the story of the Civilian Truck Schedules for 1945 in the last few weeks, but the actual final total will likely be below fondest hopes . . . Output of tanks will continue high.

DETROIT—Truck schedules are being finalized for 1945, and at this writing it appears that the comedy of errors which distinguished the 1944 allocations week by week and month by month will be repeated—doubled in spades.

As example, consider this series of events: First, last October the War Production Board announced a series of allocations for civilian vehicles for the first half of 1945. These totaled 6425 heavy-heavy trucks (24,000 lb. gross vehicle weight and higher), 26,179 light-heavy trucks (16,000 to 24,000 lb. gvw.), 80,000 mediums (9000 to 16,000 lb. gvw.) and 19,980 lights (up to 9000 lb.).

This schedule, made up of allocations to individual manufacturers, was barely finalized when it was chopped down in November. Heavy-heavy trucks, including off-the-highway models, were reduced to 5402, light-heavies to 14,830, and mediums to 72,098, while the light truck schedule remained unchanged. The new total of 112,310 vehicles represented a reduction of about 15 per cent from the original total of 132,584.

This cutback was accomplished so quietly that little was heard of it until mid-December. Shortly before Christmas newspaper stories appeared on the civilian cutbacks, but had barely gotten into print when WPB contributed anew to the picture by stating that total 1945 projections represented a doubling, rather than a decline, of output from 1944 schedule levels—from 126,678 to 245,449, of which 186,792 will be delivered domestically.

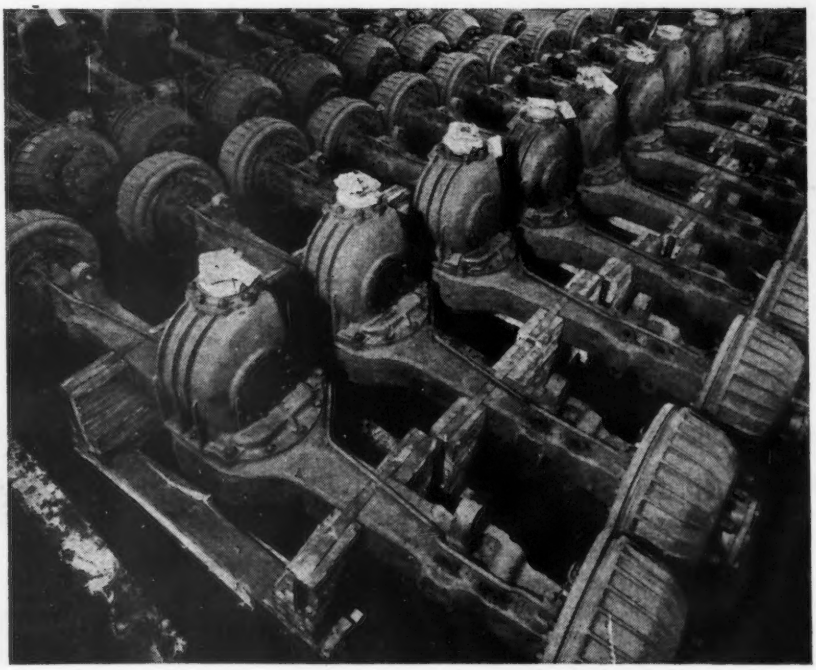
The facts of the matter indicate, hard though they may be to reconcile, that both versions as they stand today may be correct. Civilian truck output has been reduced and will continue at lower levels through the first half of 1945. It is likely that the lowered volume will continue to be maintained into the second half, even though schedules, as WPB's announcement of Dec. 23 said, have been lifted.

If Winter comes, Spring may not be far behind. But, as was glumly discovered during 1944 and 1945, if higher schedules come, actual production may be a long way behind. The heightened WPB schedules for the entire year of 1945 have a tickler hidden in them; the plants to which they are allocated must prove to the local area Production Urgency Committee that they have spare manpower to do the job. That will be difficult to do, particularly in the man-hungry Detroit area which is the heart of the light truck manufacturing program.

If an area Production Urgency Committee was alone in the road, ways might be found to go around the problem, but there are other equally formidable bottlenecks. First of these is the lack of heavy tires. This is so difficult a situation that Washington confirmed a few days ago the likelihood that civilian trucks will again have to be driven away from factories without spare tires or without extra casings on any sets of dual wheels. Actually, of course, this is merely slipping away from the issue. A dual wheel truck cannot run with a full load unless it has four tires on each axle, and whether the extra tires are ultimately obtained as original or extra equipment, they will have to come off some company's tire-making mold.

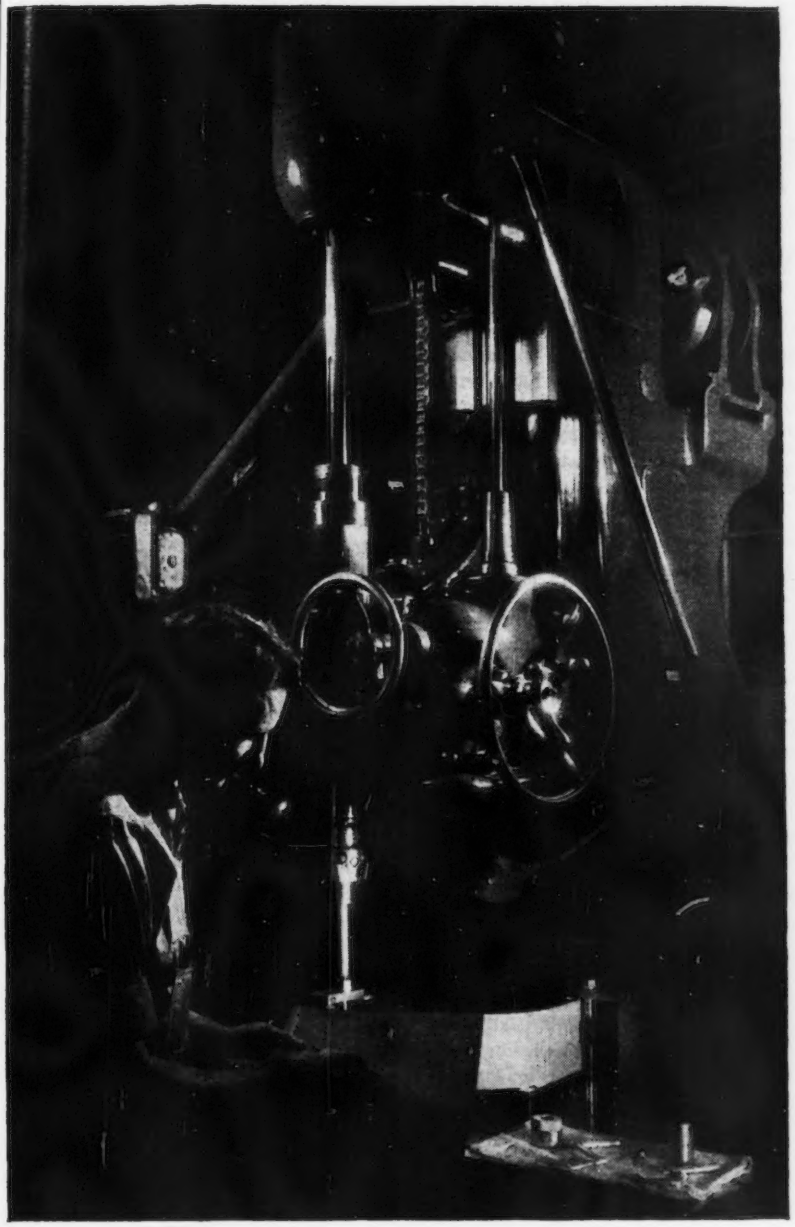
But before the trucks can reach the driveaway stage, they must be manufactured, and there, too, lies a bottleneck. In this case it is the urgent need of the Navy for engine castings and parts, and the recent directive which permits that service arm to override end-product schedules to get

BOTTLENECK BUSTERS: *Stock piles of rear axle assemblies like this are helping break the bottleneck on transmissions for heavy armored vehicles and trucks. Here are shown rear axle assemblies for the Staghound, new 14-ton Chevrolet-built armored car. Gradually increased availability of such parts lies behind reports currently coming out of Detroit that heavy truck production as well as armored vehicle production is increasing steadily to meet overseas demand.*



READY FOR *Peace...*

THE DAY IT WENT TO **WAR**



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them. In simpler words, if the Navy needs piston rings, or carburetors, or other parts, for any of the vast quantities of engines it requires, it can walk into an engine maker's plant under the directive and commandeer the parts earmarked for final assembly. It hasn't happened yet, nor is it likely to, but it's a possibility. And even if it doesn't eventuate, there aren't enough engine block castings yet to go around, nor enough foundry production of pieces for oil and water pumps. Parenthetically, Navy engines cannot be measured in parallel with hulls; a landing craft may require a dozen or 15 engines to propel it to load and unload, to open and close driveway maws, to put landing boats over the side, and even, in some cases, to put ashore with troops and provide facilities there for them. In the face of this intense demand, the civilian truck requirements may be shaved rather fine.

Then there are the military truck demands. The recent German counter-offensive on the Western Front has done our floating supply of vehicles in Europe no good. Although figures are still hidden in the smoke of the battle, it would be logical to assume that many thousands of trucks have been burned, bombed and lost during the Wehrmacht drive. Those will have to be replaced, and the situation of the war is that they probably compel first call over everything else.

Total truck schedules for 1945 appear today to stand at somewhere between 850,000 and 900,000 units, military and civilian together. This would compare with a final 1944 output of somewhere around 745,000 vehicles, which fell about seven per cent short of the final 1944 schedule of 806,042 trucks.

Because civilian requirements will have taken about 115,000 of these, the military will have obtained some 630,000. On the fact of the variety of confusing truck projection reports of the past several days, the military bite of the 1945 truck program will amount to about the same total.

On the score of mechanized equipment, it should be noted that tank production is again in an upward phase and probably will so continue during the winter months, if not beyond. The Detroit tank arsenal, operated by Chrysler, recently announced that its November output was the best for any single month of its operations except one; and gains are being registered at the other big tank production center in this district, operated by Fisher at Grand Blanc, Mich. Both these plants are tooling now for a new tank heavier than the previous 30-ton efforts.

Current deliveries, of course, are destined for the European theatre. Even if this war meets the hopes of the present-day optimists and is completed by mid-year in 1945, there will be no immediate letup in military demand. Where it was originally figured that the Pacific War would be fought with light tanks, that viewpoint is now changing as the efficiency of medium size models is being discovered in the landing operations already accomplished. As it is true in the ring that a good big man is always better than a good little man, so it probably will be proved true in the Far East that a good big tank can mop up Japs more effectively than its smaller cousins.

Advisory Committee To Discuss Proposed Price Regulation

Washington

• • • The OPA has appointed an advisory committee consisting of 12 members whose companies produce prefabricated homes and has announced that an organizational meeting will be held in January at which time discussion will relate to proposed new price regulations to replace GMPR, which freezes prices of individual sellers of prefabricated homes at March, 1942, "highs." OPA said that the present regulation does not provide a satisfactory method of pricing. It was pointed out that the resumption of large-scale production of prefabricated homes after the war will bring new producers and sellers into the industry who were not handling the prefabricated homes at the time of base pricing date.

Members appointed to the Prefabricated Homes Industry Advisory Committee are:

James L. Pease, president, Pease Woodwork Co., Cincinnati; James R. Price, president, National Homes Corp. of Indiana, Lafayette, Ind.; Henry P. Palmer, president, Allied Housing Associates, Inc., Langhorne, Pa.; Dawson W. Winn, vice-president, Green Lumber Co., Laurel, Miss.; John C. Taylor, president, American Houses, Inc., New York; W. W. Rausch, president, Holt-Fairchild Co., Arlington, Mass.; Robert Johnson, Prefabrication Engineering Co., Portland, Ore.; Walter Harnischfeger, president, Harnischfeger Corp., Milwaukee; Edward W. Green, Green's Ready Built Homes, Rockford, Ill.; J. C. Suttles, president, Houston Ready-Cut House Co., Houston, Tex.; Martel Wilson, president, Central Lumber Co., Stockton, Cal., and Austin Drewry, secretary, Gunnison Homes, Inc., New Albany, Ind.

Maritime Plate Needs To Decline in 1945

Washington

• • • Present indications are that plate production in the first half of 1945 will be more than 1,000,000 tons less per quarter compared with 1944 as a result of diminishing needs of the Maritime Commission, although the Commission will require 1,294,000 tons of plates in the first eight months of the year because of a recently decided hike of 186 ships in the 1944 program. At one time the Commission took as much as 600,000 tons of plates monthly.

Additional ships to be built will include 20 tankers, 36 Victories, 59 refrigerator ships of two types, 24 Zippers (flattop Liberties), one C-2, six C-3's, 28 APA's and 12 AKA's.

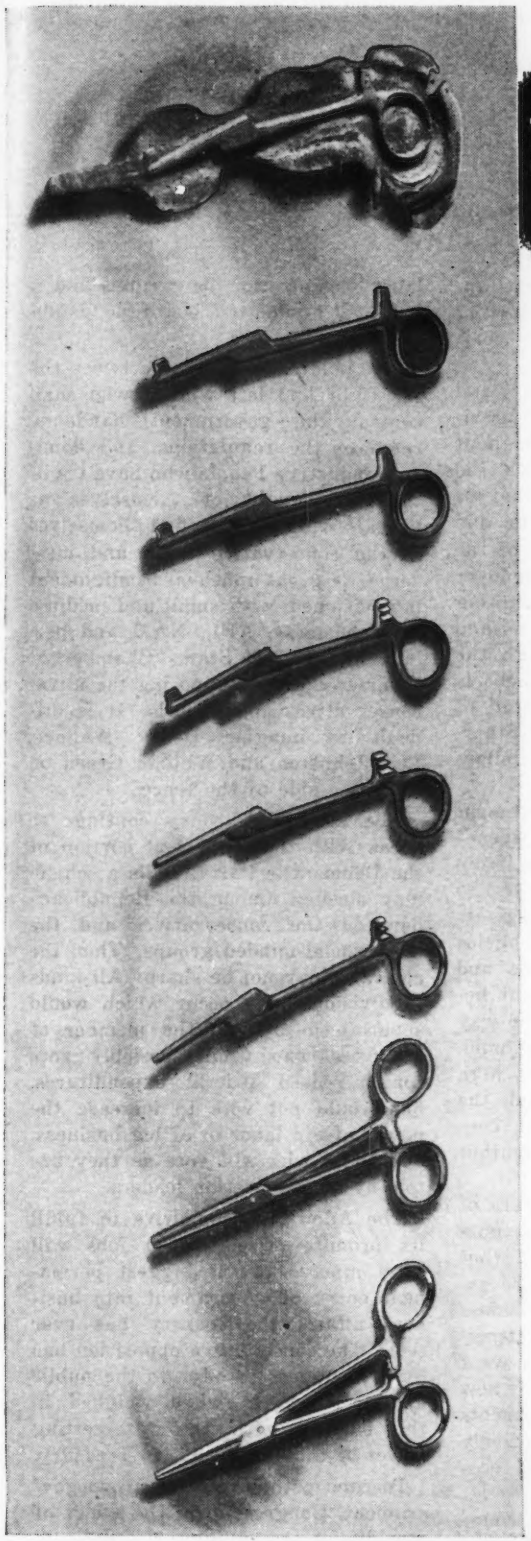
Commission plate requirements including repair needs as now estimated compared with estimates before the new increase are as follows:

In thousands of net tons

1945	New	Old	Increase
January	330	330	0
February	279	164	115
March	264	71	193
April	176	50	126
May	107	50	67
June	65	50	31
July	55	0	0
August	18	0	0
Total	1,294	715	579

With plate requirements only about 800,000 tons a month in the first quarter and 600,000 tons a month in the second quarter, WPB figures that sheared plate and universal mills will be able to take care of the bulk of orders with a limited number of orders to be placed on the strip mills.

The readjustment of the Maritime program is not expected to cause any sheet cutbacks, although it would interfere with sheet production if mills had not been hindered from scheduling more output by manpower shortages.



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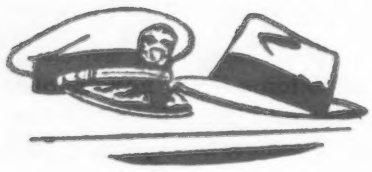
Washington . . . L. W. MOFFETT

• Size and length of the war draws industry and government closer together than ever . . . Recent State Department appointments reveal trend.



WASHINGTON — Never before in the history of the United States has industry and government been drawn together in such a close community of interest as now. The size and length of this war have been responsible.

This being true, the appointments of Edward Stettinius, Nelson Rockefeller, and William L. Clayton to high posts in the State Department, reveal a trend in government in recognition of this new relationship. Senators sensing the change in Administration policy probed the attitude of all three men on the question of cartels.

The stock State Department answer was given to the Senate Foreign Relations Committee and the Senate that the Administration is opposed to cartels. The statement by Mr. Clayton that it would be necessary for this government to enter into certain commodity agreements with foreign nations, however, was generally passed over by newspaper comments and by the attention of the Senate.

However, several high officials in the State Department believe that these commodity agreements will resemble cartels and be conducted under the aegis of government. Government cartels are thought by most industrialists interviewed as more reprehensible than private cartels because they tend to force big business to become the instrument of public policy. It is being predicted that American companies which favor these plans may awake some day to find themselves embroiled in foreign politics and forced to do many things they have no desire to do in order to maintain United States government approval of a method of conducting business which will minimize competition.

The government's foreign and domestic business policies have previously affected industry throughout the history of this country, but the possibilities were never so great as they are now. To all intents and purposes because of the scope of the war, the government is the employer of about 25,000,000 people, counting the armed forces, war workers and government personnel. Through the War Powers Act, the government is theoretically the sole proprietor of more than half of the United States factories, and owns billions of dollars worth itself.

Consequently what the government has done before such as its spend-lend practices in pump priming, from loans to farmers and businesses to public works and leaf raking—its free land and protective tariff policies including subsidies to railroads and ship lines will seem insignificant beside what the future holds in the way of federal largess. On the other hand, if the trend continues, present high taxes will seem picayune and the present degree of government controls over industry will seem feather light.

The coming years will be an era of big business, big labor, and big government. The postwar impact of what is done at the peace table can be expected to give the country's business a remodeling. From the way Democratic and Republican senators went down the line for Mr. Roosevelt's new State Department appointments shows that the Senate has tentatively approved of governmental and economic philosophies.

This does not mean that this country is approaching an era of good feeling. The old fight between labor, management and government will take a new turn with the far right and the far left being in substantial agreement on a program of government expenditures on a scale never before imagined, the creation of a permanent WPB and concomitant cartelization of a large segment of industry. This fits with CIO's adoption of a resolution at the Chicago conference that a new international labor organization be created and a national production board be established.

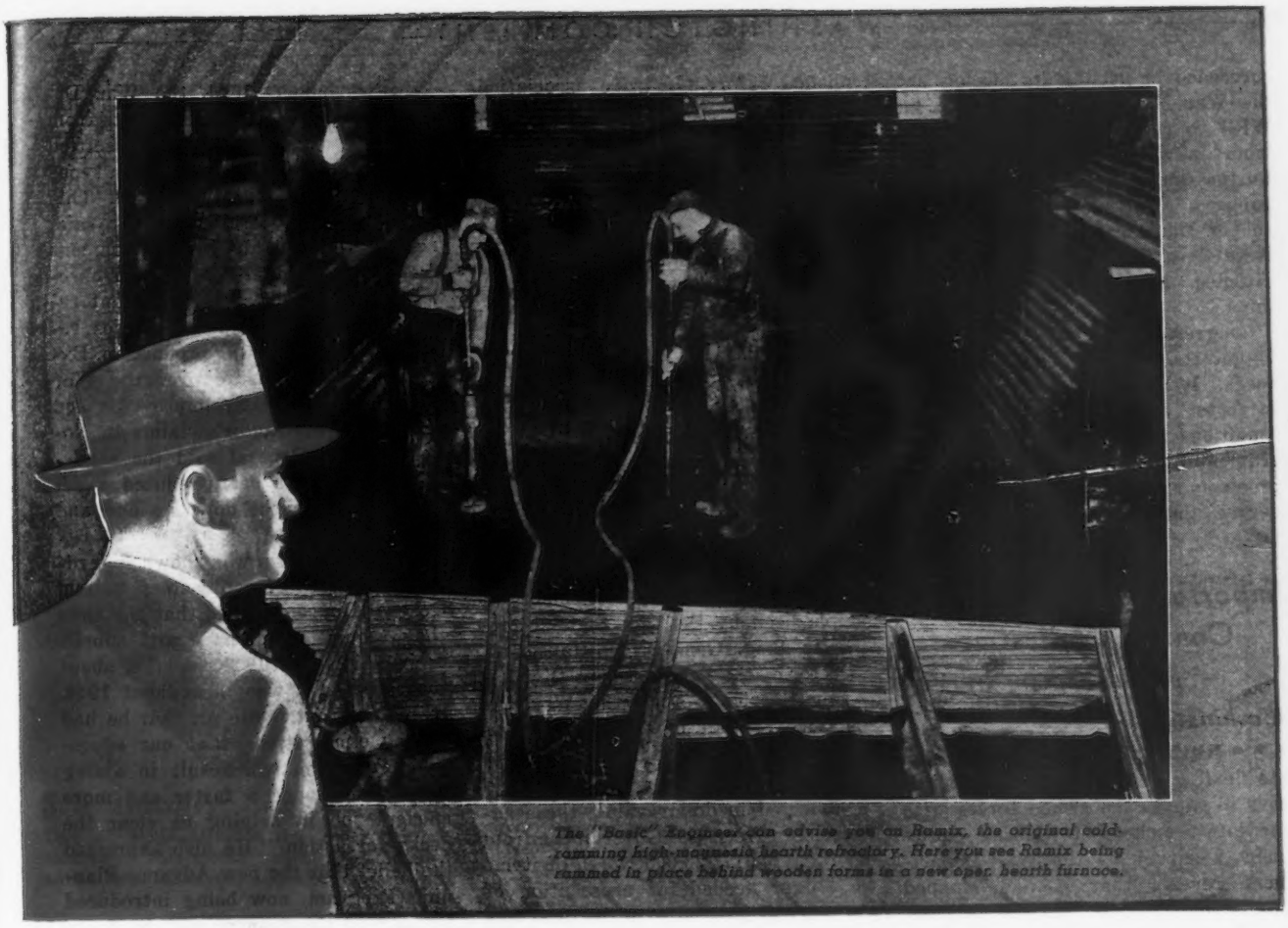
The point of difference between the far right and left will be who shall control the government handouts, regulate the regulations, and dominate industry. People who have traditionally thought of themselves as liberals will suddenly find themselves in the conservative camp and vice-versa. A great upheaval in alignment is envisioned, with small and medium sized business, AFL, NAM and perhaps the United States Chamber of Commerce groups opposing the ultra-conservatives and liberals. It is difficult to imagine Henry Wallace, Eric Johnston and William Green on the same side of the fence.

The solid South may continue to break with the New Deal portion of the Democratic Party, while a schism may develop among the Republicans between the conservatives and the more social-minded groups. Then the cleavage may not be sharp. All kinds of divisions may occur which would separate in opinion the member of Congress who would possibly vote for increased federal expenditures, but would not vote to increase the power of big labor or of big business, and those who will vote as they are told by administration leaders.

The Administration drive to fulfill its promise of 60,000,000 jobs will give impetus to the biggest permanent entry of government into business affairs the country has ever seen. The conservative opposition has little argument to offer to the public and to Congress when weighed in the balance with the vote-getting power of the United States Treasury.

To cope with larger executive government, Congress is in the midst of considering streamlining measures to make itself more efficient through acquiring a staff of experts and through merging of committees. This is a tip to business which should follow the suggestion of some of the more progressive industrial thinkers who are asking for a comparable streamlining of trade associations and an intensified participation in all legislation and regulations which affect business.

The CIO has not held back and has



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succeeded in getting its officials into the War Manpower Commission and WPB to represent the viewpoint of labor in all administrative matters. Businessmen who think that this is going a step too far should also ponder that aggressive action along these lines pays off better than dissatisfied silence on the fringe of things.

Congress cannot pay enough money to get the kind of research staff it needs. It remains for business then to foster a knowledge of industrial conditions in all departments of government and an appreciation of the problems of management to a greater degree than has ever been accomplished before. If trade associations lack lines of communication in way of observers back in the plants of various companies so that Washington representatives are not as well informed as they should be on the legislative needs of industry, this defect should be remedied. Greater activity upon the part of trade associations need not bring charges of selfish lobbyism. Business groups can overcome predjudices by exhibiting civic conscience in their demands on government. This attitude could be best expressed by refusing special privilege and looking out for the interest of government as well as insisting upon just rights.

Importance of Quick Contract Adjustments Revealed by Survey

Washington

• • • **Hitting a stride** in keeping with the flexibility of production so necessary to supply the armed forces with the latest models of fighting equipment, a survey by the War Department reveals that it had stopped production on 32,611 fixed-priced contracts, and had settled with contractors in 28,742 cases. The importance of making quick adjustments in production and contract settlements is emphasized by the fact that, according to Brig. Gen. D. N. Hauseman, director of the Readjustment Division, Army Service Forces, the War Department is not now using a single weapon in the same form or design as before Pearl Harbor.

Reflected in dollar value, these adjustments freed the Government from paying $13,617,826,000 worth of items no longer needed for prosecution of the war. Compared with the total war expenditures from July, 1941, to the end of December, 1944, this amounted to 6 per cent savings.

In November, 1944, the War Department released 1476 contracts from one type of production and settled 1623 accumulated contracts for types of production no longer needed. This action alone, General Hauseman said, served to release the Government from paying for $110,718,000 of obsolete war materiel, with attendant release of manpower and facilities required for urgent war production. Expressing his pleasure over the War Department's greatly improved speed in settling contractor's claims in November, the General said the settlement time had been reduced from over three months down to one and one-half months.

Less enthusiasm was shown regarding the record of contractors' action. General Hauseman said that the time they require to prepare and submit their claims is still 2.6 months, about the same as it was throughout 1944. He pointed out, however, that he had "great expectations that our educational program will result in aiding contractors to do a faster and more efficient job in helping us clear the decks for action." He also expressed the belief that the new Advance-Planning Program, now being introduced throughout the country will decidedly shorten the time contractors need to clear away the fiscal and property details of contract adjustment.

General Hauseman's report also showed that, of a total of over $587,000,000 of claims filed by contractors, the War Department has paid over $463,000,000. At present contractors are being reimbursed 91 per cent of the amounts claimed. General Hauseman said that these statistics indicated that contractors were filing more realistic claims and not asking for unreasonable amounts. At the same time he emphasized that in dollar volume, over 65 per cent of unsettled contracts have not yet been settled because contractors have filed no claims and that there must be improvement along these lines.

THE BULL OF THE WOODS — BY J. R. WILLIAMS

OH, YOU WANT TO SPEAK TO TH' BULL OF THE WOODS! WELL, YOU'LL HAVE TO ASK MISTER DUALWRINKLE'S PERMISSION--HE'S A VERY BUSY MAN!
LISTEN--IF I HAFTA GIT PERMISSION OFF HALF A DOZEN SIMPLE SIMONS TO SEE A MAN I'VE WORKED WITH AN' UNDER FER THUTTY YEARS, I DON'T CARE TO SEE HIM!
IT'S JUST LIKE A JUDGE--IF HE JUST DOES WHUT IT SAYS IN TH' BOOKS HE AIN'T NO JUDGE!
YEH, BUT YOU GOTTA FIGGER THAT CONDITIONS PUSH A MAN PAST HIS FEELIN'S--THIS IS TH' AGE OF PUSH!
OLD PALS
T. M. REG. U. S. PAT. OFF. COPR. 1945 BY REA SERVICE, INC.
1-5 J.R.WILLIAMS

Graham-Paige Gets B-29 Order

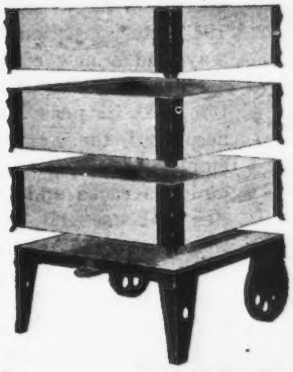
Detroit

• • • **Graham-Paige Motors Corp.,** has obtained a contract for volume production of master connecting rods for the 2200 hp. engine used on B-29 bombers. Although the company has produced huge quantities of master and connecting rods for other aircraft engines, it was said, this is the first assignment to manufacture superbomber parts.

DELIVER THE BIN AND SAVE THE HANDLING

—just one of many Labor and Cost Saving Features you get in the

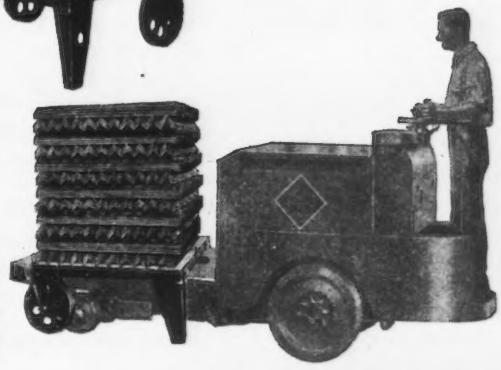
TURNER SYSTEM OF MATERIALS HANDLING

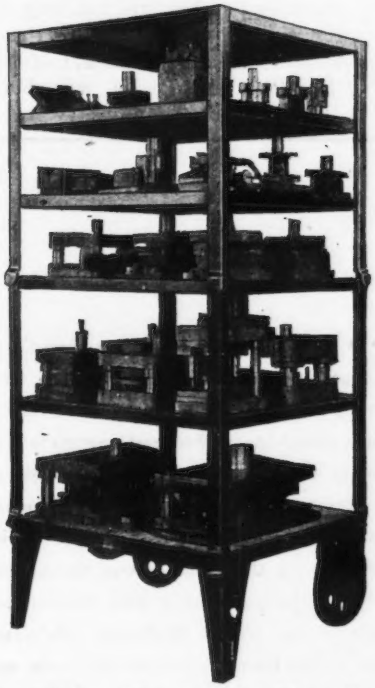


Portable Interlocking Bin Sections fit on the Turner Transport and are quickly moved with the Jimmy. As load diminishes Bin Sections are removed and placed on "empty" to build its capacity.

Scientifically Engineered to Save Manpower

Through standardization the Turner System promotes orderliness and eliminates "lost motion" among employees. Increases profits because it saves time, labor and space.





The ceiling is the limit for vertical expansion with the Turner System. Units moved by all modern methods.

Send For This Book

The whole story of the Turner System is presented in this new book which is sent free to established companies.

Wheeling Shop Box with Boxes added, moved with Shop Box Jimmy.

Simplifies Your Die Handling Problems

Rugged Die Racks interlock on the Turner Transport and dies may be quickly moved to any part of the shop. Dies are always visible and easily accessible.

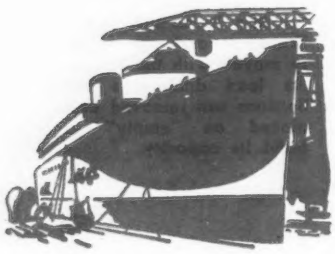
FACTORY SERVICE COMPANY

4621 NORTH TWENTY-FIRST STREET — MILWAUKEE 9, WISCONSIN

West Coast . . .

OSGOOD MURDOCK

• Despite difficulties involving priorities for material and manpower shortages Geneva Steel Works represents a feather in their cap for construction and operating people involved.



SALT LAKE CITY, Utah—While the controversy simmers on the West Coast and the East Coast as to the ultimate disposition in the postwar period of the DPC Geneva Steel Works, it is refreshing to realize that, despite a whole list of formidable obstacles, the plant is now practically completed and producing steel.

While it took some time to complete this gigantic plant west of the Rockies, it is obvious that heavy war demands in 1942 and 1943 would make it difficult to obtain the necessary equipment as well as the various auxiliaries. However, after a heartbreaking struggle against practically every construction and production problem that could be thrown in its way, the Geneva Steel Co. on Dec. 21, 1944, started operating the eighth of the plant's nine open hearths. Nine days earlier the last of four batteries of coke ovens had been placed in operation, enabling the plant to begin operating its third blast furnace.

These operating steps marked the end of a difficult path which started almost three years ago—thanks to the effort on the part of the U. S. Steel Corp. and its subsidiaries, particularly the Columbia Steel Co., builders without fee of the plant, and the extreme cooperation afforded the builders by the various manufacturers of equipment which went into the plant. Problems faced during this time included manpower shortages, lack of sufficiently high priorities and metallurgical difficulties due to the greater coal available for coking.

Construction of the plant was started in April, 1942. By February, 1943, steel erection was well underway and a new coal mine in southeastern Utah was ready for production. At its peak, construction work accounted for approximately 10,000 employees and it was necessary to build barracks and restaurant facilities to house and feed the construction crews. Fortunately some of these men elected to remain with the plant as part of its operating force. The company by no means, however, had easy sledding on obtaining even a below-minimum number of operating personnel. Its goal for steel workers was about 5000 and the plant now has about 4000. The means and methods by which personnel officers of the Geneva Co., as well as U. S. Steel subsidiaries obtained these workers, will probably become an historical (and maybe hysterical) series of antedotes on the ways and means of building something from nothing.

In August, 1943, as the plant neared operating stage, Walther Mathesius was named president of the new Geneva Steel Co., formed to operate the plant without profit for the government. Previously Columbia Steel Co., a West Coast subsidiary, had carried on the task of constructing the integrated steel mill.

Now came the job of tying the loose ends together, finding the missing parts in the overall operation picture, speeding to completion the final equipment and obtaining against almost insurmountable odds the necessary working force. Fortunately U. S. Steel has seen fit to release to the DPC as president of the Geneva one of their ace operating men, who already had to his credit a long record for getting things done in the right way in a minimum amount of time.

Walther Mathesius was born in

WALTER MATHESIUS

o o o

• • • When the United States Steel Corp. became the agent for the DPC and built and agreed to run the Geneva Steel Works they picked one of their best operations men to run the new plant. No chances were to be taken on allowing the government plant to be anything but the best run steel works. For that job U. S. Steel offered the services of its Delaware Corp.'s Vice President of Operations, Walter Mathesius. Definitely an up-from-the-ranks man his major aim was to get the plant going—which was done in record time.

o o o

NEW! The TOCCOTRON

NOT a laboratory instrument but a SHOP TOOL for electronic induction heating

HERE is a NEW electronic tube type induction heating machine—the result of four years' tests and development. It is designed and built to stand the gaff of shop usage. This is another TOCCO *first* for it means that radio frequency induction heating equipment has been taken out of the class of a laboratory instrument and developed into a dependable shop tool for uniform, low-cost production. Note the features of the TOCCOTRON:

RUGGED PRODUCTION MACHINE. Power tubes and contacters are shock-mounted. Fully protected. No radio-frequency radiation. No high voltage hazards. Tube filament voltages are automatically held constant over a wide range of line voltage variations.

A PACKAGED UNIT. Completely self-contained in all-metal cabinet. All sub-assemblies are easily accessible. All timers and necessary controls are integral with the machine, as is the sink type work area.

FASTER. Only electronic tube type induction heating unit with two independently controlled work stations which can be set up for different jobs for operation at same or different frequencies. Convenient control of power output over wide range.

Available in 20 K.W. output with nominal frequency of 450,000 cycles. Typical applications: Small parts . . . hardening, brazing, annealing, heating for forming. Sharp contours such as hardening of cutting edges. Shallow penetration in surface hardening.

Full details in Bul. 20. Consult the TOCCO Engineer for a study of *your* problems in Induction Heating. His analysis is unbiased because TOCCO manufactures both motor-generator and electronic tube types of equipment.

THE OHIO CRANKSHAFT COMPANY • Cleveland 1, Ohio

TOCCO

INDUCTION

HARDENING . . BRAZING

ANNEALING . . HEATING

Germany, the son of a professor of metallurgy. He took his doctorate in engineering at the Institute of Technology, Berlin-Charlottenburg. He came to U. S. Steel in 1911 and served for many years as general superintendent of South Works of Carnegie-Illinois. In 1939 he was made manager of operations of Carnegie-Illinois' Chicago district, and three years later became vice-president of operations, U. S. Steel Corp. of Delaware.

At the time of the organization of Geneva Steel Co., the four batteries of coke ovens were 70 per cent completed, and the maintenance shop was ready for operation. In December, 1943, the first coke was produced. The first blast furnace went into operation 30 days later, and on Feb. 2, 1944, the first steel was produced. First plates were rolled in March.

Probably the most unconcerned people in the controversy over who will run the Geneva plant after the war, whether it will run or not, and who will buy the steel, are Mr. Mathesius, his general staff and his workers. Their problem was to get the mill running and produce steel for the Armed Forces as rapidly as possible. This they have done and this they are still doing. When the time comes for definite postwar plans and thinking for the Geneva plant, they will probably be as ready as the next person to throw in their two cents as to the future of the company. It is recalled that, for the time being at least, the Geneva Steel Works is the property of the government, the officers are agents of the government and their sole purpose is to operate the plant and produce steel for the war effort. There seems little doubt that if this were not the case and were these officials free to express their own private opinion, they could probably give considerable concrete information as to Geneva's future capabilities and potentialities.

* * *

It is reported that a group of New York financiers in the past week have purchased all of the Rockefeller interests in Colorado Fuel & Iron Co., Pueblo, Colo. This is said to amount to more than 50 per cent of both stock interest and bond interest in the company. It is reported that Allen & Co. is head of the New York group which has made the buy.

* * *

To meet increasing demand for its products, Drayer & Hanson, Inc., Los Angeles, manufacturers of heat exchange equipment, have leased the entire building formerly occupied by the Los Angeles Lighting and Fixture Co.

Electrons Regulate Plane Temperatures

Minneapolis

• • • **Postwar air travelers** will depend upon tiny coils of wire and electron tubes to keep warm while roaring through the sub-stratosphere, an announcement by the Minneapolis-Honeywell Regulator Co. revealed recently.

The coils, like fingers reaching ahead of the plane, will anticipate temperature requirements and deliver more or less heat even before passengers realize what's going on in the outside air, it was said.

Completely automatic, the device goes under the lengthy name of the Electronic Cabin Temperature Control System and has been in test service on several airlines and combat use on Army transport ships for some time, R. H. Whempner, chief field engineer for the company's aeronautical division, said.

"Controlling temperatures in a house is one thing," Whempner said "but controlling temperatures in an airplane is quite another. A home, unless a cyclone comes along, stays put and thus outside temperature variations fluctuate only gradually. But an airplane moves from one temperature condition to another in a matter of seconds, and sometimes these changes are as much as 50 degrees or more."

For those interested in how the electronic wizard anticipates atmospheric jig-sawing, the Honeywell engineer explained that the system includes an outside air compensator. This, he said, is a small coil of wire installed in the duct bringing outside air into the plane's heaters. Temperatures fluctuations change the electrical resistance of the wire and although this change is only slight, it can easily be measured through electron tubes. Serving as the brains of the system, the tubes learn from the coil that the outside air is colder or warmer, as the case may be, and they send electrical messages to a motor which opens or closes a mixing damper and thus proportions the amounts of outside air with heated air from the plane's heaters.

The system also includes a cabinstat, Whempner pointed out, which is another coil of wire mounted in the cabin and serving about the same function as a thermostat in a house. This, too, interprets temperatures and sends messages to the electron tubes which, getting signals from both coils, positions the mixing damper to maintain the selected inside temperature. The latter, he said, is determined by a small dial mounted in the cockpit.

Workers' Earnings Down Fractionally During October

New York

• • • **In the twenty-five** manufacturing industries surveyed each month by the National Industrial Conference Board, average hourly and weekly earnings of workers sagged slightly from the record highs of September, while "real" weekly earnings were 0.5 per cent below the June record.

These figures, which include overtime and other monetary compensation, were $1.078 for hourly earnings, a decline of 0.2 per cent from September, and $49.32 for weekly earnings, also a decline of 0.2 per cent.

Key figures of the conference board's survey for September are:

Hourly earnings declined 0.2 per cent to $1.078. They were 4.1 per cent higher than in October, 1943, 42.0 per cent above January, 1941, and 82.7 per cent above the 1929 level.

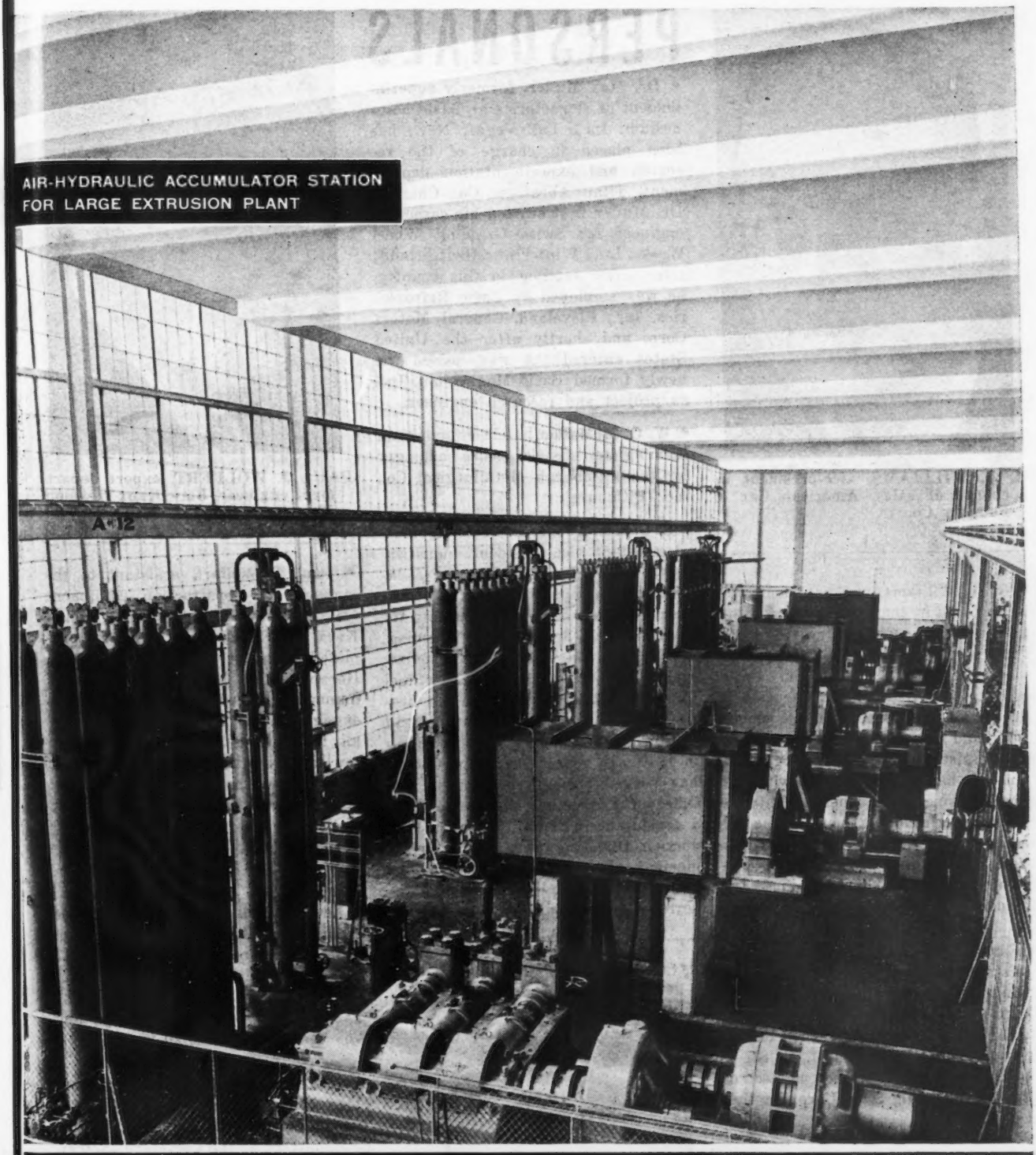
Weekly earnings at $49.32 were 0.2 per cent below those of September. They have risen 3.9 per cent since October, 1943, 61.1 per cent above January, 1941, and 72.7 per cent above 1929.

"Real" weekly earnings, or dollar weekly earnings adjusted for changes in living costs, were 0.2 per cent lower in October than in September. They were 2.4 per cent above October, 1943, 32.0 per cent above January, 1941, and 64.6 per cent higher than those of 1929.

Hours per week remained unchanged at the August and September level of 45.6. This was 0.1 hour or 0.2 per cent more than in October, 1943. They were 5.4 hours or 13.4 per cent longer than in January, 1941, but 2.7 hours or 5.6 per cent shorter than the average work week in 1929.

Employment declined 1.2 per cent in October. Since October, 1943, employment in the twenty-five manufacturing industries has declined 10.0 per cent, but it was 23.6 per cent greater than in January, 1941, and 33.5 per cent greater than in 1929.

Man hours declined 1.1 per cent. They averaged 9.7 per cent below those of October, 1943, but were 40.3 per cent greater than in January, 1941, and 26.0 per cent greater than in 1929.



AIR-HYDRAULIC ACCUMULATOR STATION
FOR LARGE EXTRUSION PLANT

HYDROPRESS · INC.

ENGINEERS CONTRACTORS

HYDRAULIC PRESSES · ROLLING MILLS
STRETCHERS · PUMPS · ACCUMULATORS

570 LEXINGTON AVENUE · NEW YORK · N. Y.

PERSONALS

R. A. WILLIAMS, vice-president in charge of sales, American Car & Foundry Co.

• **R. A. Williams,** vice-president, has been placed in charge of sales for the American Car & Foundry Co., New York, succeeding **William L. Stancliffe** who recently resigned from those duties. Mr. Williams was elected a vice-president of a.c.f. in December 1941, and has been Mr. Stancliffe's chief assistant in the sales organization. He has been associated with the company since 1924 when he entered the engineering department at the St. Louis plant. More recently he has been district sales manager at the Cleveland and Washington offices of the company.

• **Earle D. McKay** has been appointed assistant vice-president in charge of industrial relations, Wheeling Steel Corp., Wheeling, W. Va., succeeding **R. C. Cooper,** who has resigned to accept a position with the U. S. Steel Corp. Mr. McKay has been connected with the Wheeling Steel Corp. for the past six years.

• **Jack Hoffman,** formerly manager of the Cleveland territory for Udylite Corp., Detroit, has been transferred to the Detroit office to head the newly organized commercial filter division. **Bert Lupien,** formerly Michigan representative for the corporation, has succeeded Mr. Hoffman in the Cleveland territory. **Joe Hoefer,** formerly with Udylite, returns to the corporation as sales and service engineer for the Michigan territory. **Leonard Singer,** engineer for the Udylite home office for several years has been transferred to the New York office.

• **Dr. Max Muller,** formerly superintendent of refractories at Basic Magnesium, Inc., Las Vegas, Nev., has been placed in charge of the research and experimentation department, Titan Abrasives Co., Chicago. Dr. Muller first started his career as engineer for Swiss Grinding Wheel Works, Ltd., Winterthur, Switzerland; later, after settling in this country, he was employed by Basic Refractories, Inc., Cleveland, General Motors Corp. and shortly after the United States entered the war, joined the newly formed Basic Magnesium, Inc. as project and research engineer.

• **W. O. McMahon** has been appointed Birmingham district sales manager for the Pittsburgh Metallurgical Co., Inc., Pittsburgh.

• **R. Conrad Cooper** has been appointed assistant vice-president, industrial relations, U. S. Steel Corp. of Delaware. Mr. Cooper was assistant vice-president in charge of operations for the Wheeling Steel Corp., Wheeling, W. Va., at the time of his appointment. He went to the Wheeling Steel Corp. in 1937 as assistant to the vice-president in charge of operations and was promoted to his present position in 1940. In recent years Mr. Cooper has served the government in the Office of Production Management, as a consultant in the WPB Labor Production Division and as an industry member of the Management Labor Policy Committee of the War Manpower Commission.

R. CONRAD COOPER, assistant vice-president, industrial relations, U. S. Steel Corp.

PAUL J. WOLFERT, export department engineer, Blaw-Knox Division, Blaw-Knox Co.

• **Paul J. Wolfert,** assistant to the manager of construction equipment of the Blaw-Knox Division, Blaw-Knox Co., Pittsburgh, has been promoted to export department engineer. He will assist H. T. Schwier, export manager in New York, and will be engaged in the promotion and sale of all the various Blaw-Knox products for the export trade. Mr. Wolfert joined Blaw-Knox as a sales engineer at Pittsburgh in 1939; in the spring of 1942, he was promoted to assistant to the manager of construction equipment.

• **Leon R. Baker** has been appointed general European manager for Lempco Products, Inc., Bedford, Ohio, with headquarters in London. Mr. Baker has been actively connected with the machine tool industry in Europe and America for the past 20 years.

• **Paul B. Sagar** has been appointed eastern field engineer for General Controls Co., Glendale, Calif., with headquarters at the Cleveland factory branch. **James King** has become field sales engineer in the New York factory branch.

• **Lt Col. Alden F. Erikson** has just returned as district manager of sales for Wyckoff Steel Co. at their Boston office. Col. Erikson has been in military service for the past 30 months, serving in the South Pacific war area as an officer in the coast artillery service and later in the anti-aircraft division. Prior to entering the service in 1942, Col. Erickson held this same sales post for Wyckoff.

"A name worth remembering"

Fairbanks-Morse

Practically every industrial equipment problem that is submitted to Fairbanks-Morse is similar to problems we have previously solved at some time during our 115 years in business. If you have a problem we invite you to draw on our broad, successful experience in applying Diesel engines, generators, motors, pumps, or scales to the needs of industry.

R. A. Morse Jr.

General Sales Manager

Sturdily built without springs or delicate parts, Fairbanks-Morse Scales are more than highly accurate weighing instruments. In their countless types, styles, and modifications they weigh while materials are *moving*, furnish *printed* weight records, *count* small parts and products, weigh and disburse preset amounts *automatically*, and can keep ingredient proportions *secret*.

Fairbanks, Morse & Co.
Chicago 5, Illinois

Scales

Diesel Locomotives • Diesel Engines • Generators • Motors Pumps • Scales • Magnetos Stokers • Railroad Motor Cars and Standpipes • Farm Equipment

BUY MORE WAR BONDS

© 1944. Fairbanks, Morse & Co.

PRECISION CASTINGS

Sir:

In the letter from Mr. Karl Scheu of the Terry Co. in "Dear Editor" for Dec. 7, only controlled expansion of the ceramic was considered and not the tolerances for a master mold made from waxes or other fusible patterns, or the accuracy with which metal can be melted and poured.

It would also be well to point out that it is not always practical to manufacture investments in carload lots in such a manner that the composition is uniform enough to control expansion with the accuracy mentioned; although in small quantities, in laboratory use and in dental casting, I will agree with him that the factors controlling investments can be held to the tolerance he mentions.

B. L. LEVINSON,
Vice-President
B. F. Hirsch, Inc.,
175 Varick St.,
New York 14

CHICAGO SCRAP PRICES

Sir:

In checking our price records for iron and steel scrap, there is a discrepancy in No. 1 machinery cast at Chicago. Your annual review sections of January 1, 1920 and January 1, 1931 indicate that this is quoted in dollars per net ton, but your annual review published January 7, 1943 contains a note stating that this series has been changed from a gross ton to a net ton basis as of April 30, 1941 with a consequent break in the data. To put the series on a comparable current basis we would appreciate information on the change which took place as of April 30, 1941.

F. H. KENLY
Economics Div.
Standard & Poor's Corp.,
345 Hudson St.,
New York 14

● Prior to April 1941 when OPA maximums were decreed for scrap by the issuance of MPR-4, machinery cast scrap at Chicago was quoted on a net ton basis. Since that time, like all other scrap grades, it is quoted on a gross ton basis. Our identification and footnote in the 1943 annual review are in error.—Ed.

STEEL LABOR COST

Sir:

What percentage of the total manufacturing cost of steel is represented by labor cost?

FREDERICK L. MILLER
Graham, Parsons & Co.,
14 Wall St.,
New York 5

● Statistics of the American Iron and Steel Institute indicate that 40 per cent of sales represents labor costs. Perhaps this figure will serve your purpose.—Ed.

DRAWING STAINLESS

Sir:

Please recommend a steel for drawing Stainless Steel No. 321. Draw 90 deg.—1½ in. R.—1½ in. depth, 1600 deg. scaling temp.

H. R. GOGAY,
Director, Research Dept.
The Douglas T. Sterling Co.,
Gurley Building,
Stamford, Conn.

● There are many factors involved, including the selection of a suitable drawing compound, the press speed, clearance between the punch and the die, and the smoothness of die finish.

Only the most durable tool materials can be expected to give a useful life when called upon to withstand severe deep draws with austenitic steel. Plain carbon tool steels are generally of little use. Nitrided tool steels give much better wear provided the core has relatively high hardness to prevent the case from caving in. One variety of tool steel suitable in fairly heavy draws contains from 1.5 to 2 per cent carbon with about 3 per cent tungsten. The high carbon, high chrome class of tool steels has also been used in drawing stainless steel but it is highly necessary that lubrication be given because of the affinity of stainless steel for the high chrome type tool steels. Chromium plated tools have given satisfaction, particularly on light draws but the plating must be exceptionally good and the underlying steel must have ample strength to withstand the high pressure involved.

The recommendations of tool steel suppliers and suppliers of drawing compounds will be helpful.—Ed.

HOBBING PLASTIC MOLDS

Sir:

Can you tell us where to get information on hobbing as applied to plastic mold making?

GEORGE E. GANSER
G. & S. Tool Co.,
3617 N. Smedley St.,
Philadelphia 40

● "Plastic Molds" by Gordon B. Thayer, published by American Industrial Publishers, 312 Fairmount Cedar Building, Cleveland, at $3.50, has a chapter on methods of mold sinking which starts off with a description of hobbing practice.—Ed.

SCRAP PRICES

Sir:

It is very necessary for us to have you continue the publication of prices of scrap in the open market as your published prices are settlement prices for scrap sales contracts. Even though the market is returning to OPA ceilings in spots, will THE IRON AGE continue to publish open market prices so there will be a basis for settlement?

C. R. STEVENS,
Purchase Engineer
Westinghouse Electric & Mfg. Co.,
East Pittsburgh, Pa.

● In view of the possibility of fluctuation in market prices of scrap iron and steel THE IRON AGE proposes to continue listing scrap prices in all districts, even if they may be at ceilings.—Ed.

CONTROLLED FOIL WINDING

Sir:

In the issue of May 11, page 11[illegible] there is a paragraph and illustration of a winding machine for capacitors using electronic control in the winding of the tinfoil.

Would you please be good enough to advise us the address of the suppliers of such equipment?

A. L. TAYLOR
Plant Development Dept.
Joseph Lucas, Ltd.,
Great King St.,
Birmingham 19, England

● The winding machine for capacitors using electronic control, refers to the Westinghouse Mot-O-Trol electronic drive. Your letter has been passed along to Westinghouse Electric International Co. for information on this drive.—Ed.

POSTWAR HOMES

Sir:

Please send additional details of residence construction of architect Ernest Gunnar Peterson mentioned on page 134 of Dec. 7 issue.

JAMES MURPHY
The Yoder Co.,
West 55th St. and Walworth Ave.,
Cleveland 2

● We would suggest that you might wish to communicate direct with the architect at Falmouth, Mass. The pipe for the radiant heating installation was supplied by the A. M. Byers Co., Pittsburgh, Pa.—Ed.

TEST SPECIMENS

Sir:

Please give me further details of the standard round notched Izod impact test piece illustrated on page 53 of the Oct. 5 issue. Is there any standard round piece for bending test? It is easier to use a round specimen even if it is convenient to machine two parallel surfaces in the middle for bend testing.

F. FABRIANI
Arsenal de Marinha da Ilha das Cobras,
Rio de Janeiro, Brazil

● The round notched Izod impact test piece pictured in the article on high frequency centrifugal casting is covered by our Federal Standard QQM-151. This round impact specimen is rarely used, since the specification also lists the standard ASTM 10 x 10 mm. square test specimen (ASTM Spec. E-23411T) which is almost universally used in industry.

As far as we know, there is no standard round piece to be used in a bending test. The present ASTM specification merely states that round bars may be tested in bending but the results will only be comparative since for the same material the fiber elongation varies with the diameter.—Ed.

SEIZED FOREIGN PATENTS

Sir:

Please send me the 48 page booklet listing all seized foreign patents published serially by THE IRON AGE. Enclosed is 30c. in stamps.

DORIS K. MARTIN
Metal Finishing Service
333 No. Michigan Ave., Chicago

● Booklet mailed.—Ed.

WHAT you gain by having skilled spring engineers design your springs is vividly demonstrated in Adel's "Mighty Midget" Hydraulic Selector Valve. 76% lighter and 72% smaller than previous designs, this unit measures only 1½" x 2½" x 2¼". Considering these dimensions, you can well imagine the tiny size of the Muehlhausen Springs—the nerve center of the "Midget's" operation.

These springs are tiny in size only. Their operating characteristics and the amount of engineering skill that goes into them would cause many a man-size spring to take a back seat. Designed to meet precisely every requirement of the job, these springs were a vital factor in the development of this remarkable valve.

Improvement in product performance and added product life are always assured when using *designed* springs. MUEHLHAUSEN SPRING CORPORATION *(Division of Standard Steel Spring Company)*, 817 Michigan Avenue, Logansport, Indiana.

***To improve product performance, use* MUEHLHAUSEN Designed SPRINGS**

This Industrial Week . .

- ***War Pressure on Steel Intensifies***
- ***Order Volume Up Despite Holidays***
- ***More Freight Car Inquiries Out***

BECAUSE of events abroad the steel industry in the past week was feeling the full effects of an overall pressure stemming from the now general belief that the war in Europe will be no push-over and might take much longer to finish. New bookings and heavy steel production continued to bear out such a viewpoint.

Despite the holidays steel orders rose sharply again last week and sales offices reported their customers more war production minded than at any time since Pearl Harbor. Forge shops and structural steel fabricators have acquired comfortable backlogs even though the latter had run out of landing craft contracts.

The Maritime Commission is expected to require 1,294,000 tons of plates in the first eight months of this year because of a recent increase, totaling 186 ships, in last year's program. The additional ships included tankers, Victories, refrigerator ships, flat-top Liberties and others. With the commission still depending to some extent on inventories, plate shipments to that agency during the first half of this year may be somewhat under the same period in 1944. However, conversations in the steel trade last week were still revolving around the possibility of further increases in Maritime Commission projects.

Steel deliveries have lengthened considerably in the past 30 days, particularly on narrow gage and highly flat rolled products and carbon bars. This reflects heavy pressure of CMP orders and WPB delivery directives.

STRIP mill size sheets in many cases are now promised for June delivery and galvanized sheet promises have lengthened from June to August. Some producers are promising tin plate shipments for April whereas a short time ago February deliveries were available. Cold rolled sheets have been extended to May from March; hot rolled sheets to May and August from March; carbon bars to June and July from March and April; some sheared plates to June from April; wider sheared plates unchanged to March, and universal plates remaining unchanged from March promises in most cases. Narrow and wide strip were still being promised for May delivery.

First expedient taken recently to relieve some of the tight delivery situation has been to cutback first quarter tin plate directives to 1944 fourth quarter levels after they had been raised. Space, freed on the mills, will go partially into galvanized sheets and possibly, in some cases, into rails. So far the increased rail steel directive for the industry for the first quarter appears safe, but an unlooked for jam in shell steel output could easily change this picture.

Steel mills are fearful that rapid increases and production directives for war programs will extend carryovers. At least one mill has gone into 1945 with a substantially larger carryover than at the beginning of September, but one steel company reports a current carryover less than one-third of its peak six months ago. The carryover situation now, however, centers in sheets and shell steel rather than in plates which were the most delayed item previously.

WAREHOUSES in some areas have been soliciting support from their customers in a new effort to impress WPB with their importance to essential industry. That this importance may be greater now than it was a few weeks ago during the anticipated reconversion trends, is well within the realm of reason. If some orders are forced off mill books or delayed by production directives for munition steel requirements, customers will have to turn to warehouses and excess stocks to maintain their material purchases.

New inquiries for 3500 freight cars, most of them 50-ton box cars and many of them high strength steel, have been received during the past week. The following inquiries are for 50-ton box cars: Southern Pacific 500; Union Pacific 1000; Santa Fe 500; Denver & Rio Grande 500; Colorado & Wyoming 100; Seaboard Airline 800; Toledo, Peoria & Western 50. St. Louis Southwestern Railway is inquiring for 25 70-ton covered hopper cars, while Erie Railroad has ordered 500 50-ton box cars from American Car & Foundry, Chicago.

Transportation equipment division of WPB has authorized construction of the following freight cars in the months indicated: Grand Trunk Western, 500 40-ton box cars by Pressed Steel Car Co., July; Central Railway of Georgia, 100 50-ton pulpwood cars by Greenville Steel Car Co., June; Chicago & Northwestern, 400 50-ton cars by American Car & Foundry, July; National Railways of Brazil, 750 40-ton box cars by Pressed Steel Car Co., August-September and 250 40-ton gondolas, September; Northern Railways Co. of Costa Rica, 100 20-ton flats and 20 20-ton box cars by Magor Car Co., September.

AMERICAN Car & Foundry at St. Charles, Mo., has been authorized to build four dining cars for Louisville and Nashville in September. One locomotive works reports a substantial reduction in its Army locomotive program following recent cancellations.

The OPA, it has been learned, concedes that a steel price adjustment on certain products is in order because of increased costs accumulated before the recent wage award. Increased costs because of the latter will be studied by OPA as soon as data are supplied from steel companies. This material will be in the hands of OPA by Jan. 8 and it will probably take several weeks after this before definite action on the overall question of steel product price relief is taken.

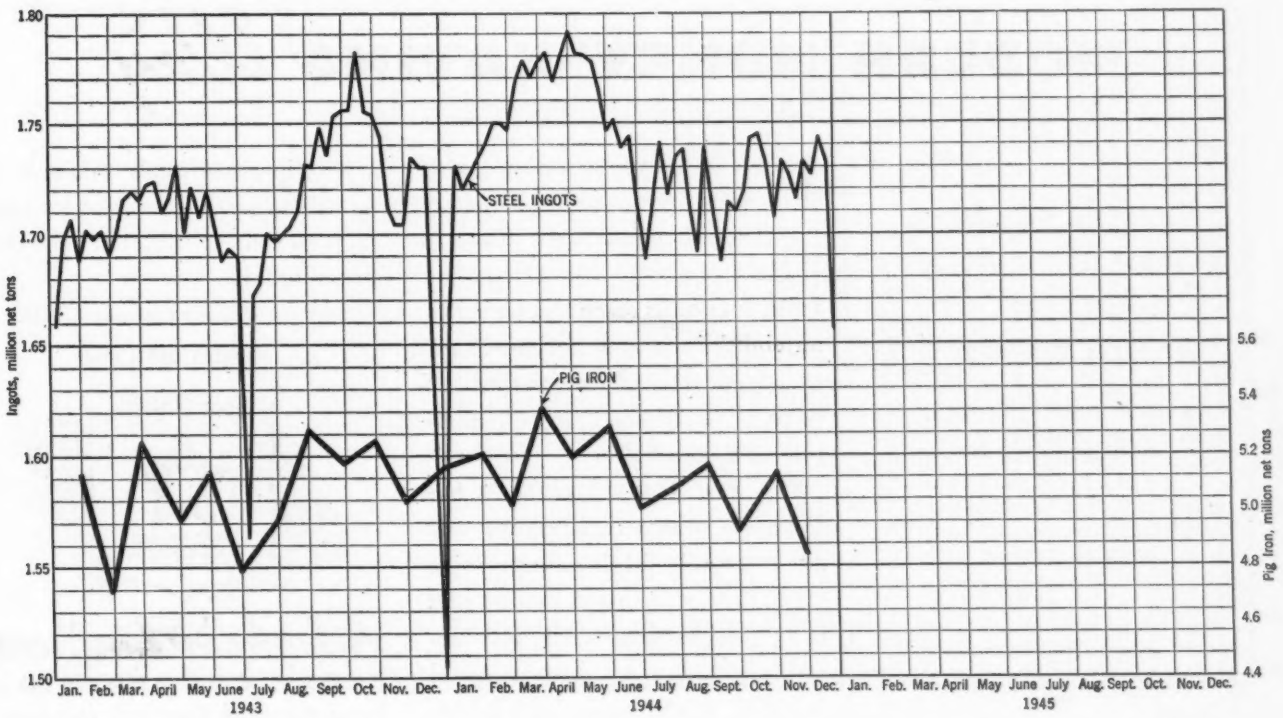
• **USE OF WAR PRISONERS**—Wider use of prisoners of war, 3200 of whom are already employed in Ohio, in areas of acute manpower shortage where American workers are not available, was urged recently by Robert C. Goodwin, WMC regional director for Ohio, Michigan and Kentucky. Goodwin recommended that area directors ask their labor-management committees to study at once the possibilities of making fuller use of war prisoners to help alleviate manpower shortages, and pointed out that the enemy is using American prisoners whenever possible. In Ohio, prisoners have been or are being used in food processing, sugar refining, road repair, bridge repair, foundry yard labor, auto wrecking yard labor, cutlery grinding and polishing, brake lining manufacture, stone quarrying, agricultural limestone quarrying, fertilizer plants, feed mills, general warehouse trucking, basket manufacturing, greenhouse and nursery work, cement block making, captive railroad track repair, motor coach line bus repair and in all types of agricultural work. Prisoners have been employed around such Ohio communities as Toledo, Fremont, Sandusky, Norwalk, Clyde, Port Clinton, Oak Harbor, Fostoria, Tiffin, New London, Lacarne, Woodville and Defiance.

• **FABRICATED STEEL**—November bookings of fabricated structural steel for bridge and building construction reported to the American Institute of Steel Construction by companies representing 75.5 per cent of the total average of the industry during the years 1923-1925, totaled 59,150 tons. This figure compares with 76,709 tons for October and 34,093 tons for November of last year. The reported November shipments for bridge and building construction totaled 47,365 tons as compared with 42,741 tons reported for the same months last year. The reported tonnage available for future fabrication at Nov. 30 was 184,239 tons.

• **HEAVY TRUCKS BEHIND**—Production of heavy-heavy trucks in November was 37 per cent greater than in June, and light-heavy trucks were up 33 per cent, figures of the Detroit Regional War Production Board show. However, as of Dec. 1, heavy-heavy truck production was 15 per cent behind schedule, and light-heavy truck production was only 2 per cent ahead of schedule. Production of large truck and bus tires was 5 per cent ahead of schedule, having risen 30 per cent in November since June.

• **CONCILIATION SERVICE**—In November 1944, the U. S. Conciliation Service disposed of 2017 cases involving 1,340,934 workers. Included in this total were 248 cases in the iron and steel industry. In October the service disposed 2325 cases involving 1,033,364 workers, and these cases included 236 in the iron and steel industry. The November iron and steel cases involved 82,728 workers compared with 57,842 in October. A breakdown of the iron and steel cases disposed of for November shows 33 strikes involving 21,214 workers; 18 threatened strikes involving 6585 workers, and 105 controversies involving 27,792 workers. In November the Conciliation Service certified 73 iron and steel cases with the National War Labor Board, involving 26,579 workers. This compares with 56 iron and steel cases certified in October which covered 20,059 employees.

• **ALLOY STEEL OUTPUT OFF**—Production of alloy steels during November totaled 803,507 tons, about 11 per cent of total steel production during that month, according to the American Iron & Steel Institute. In October, 842,392 tons of alloy steel were produced. In November a year ago alloy steel production was 884,003 tons. In the first eleven months of 1944, alloy steel production totaled 9,677,204 tons, compared with 12,316,996 tons in the corresponding period of 1943. Open hearth furnaces produced 559,231 tons of alloy steel in November. The remaining 244,276 tons of alloy steel production came chiefly from electric furnaces.



Week of	Pittsburgh	Chicago	Youngstown	Philadelphia	Cleveland	Buffalo	Wheeling	South	Detroit	West	Ohio River	St. Louis	East	Aggregate
December 26...	80.0	100.0	87.0	92.0	95.0	106.5	87.0	99.0	92.0	86.0	95.5	90.5	86.0	92.0
January 2.....	89.0	100.0	92.0	96.0	96.0	106.5	91.0	99.0	97.0	89.5	95.5	94.5	90.0	95.0

Note: All rates for Jan. 2 are estimated

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OPA Favors Steel Price Adjustment on Past Costs

New York

• • • The Office of Price Administration for some time has been of the opinion that the steel industry has and still is entitled to price adjustments on certain steel products. That much was officially conveyed to The Steel Industry Advisory Committee recently.

However, it is believed that the price relief which the OPA believes is due the steel industry covers accumulated increases in steel making costs, exclusive of the recent wage award and its retroactive feature (see THE IRON AGE, Dec. 7, page 109 and Dec. 21, page 93 for background details).

In the steel industry request, relief was also asked for any subsequent effects of the recent wage award and also for increased cost which will result from back pay. As reported previously the industry through its OPA advisory committee began a few weeks ago to work up basic cost data from which the OPA would draw overall conclusions for its eventual stand on the subject of steel price inequalities. It is expected that around Jan. 8 the steel industry will have supplied cost data for OPA's study. About two weeks later, the latter is expected to make general recommendations to the committee which will be followed by the usual negotiations as to the definite products which will be adjusted.

One stumbling block may be the method of solving the steel industry's problem in recovering price relief because of retroactive pay awards. Some officials in OPA are said to favor a temporary price adjustment over and above a general one in order to take care of the retroactive costs in wages. Such a program envisions a final basic adjustment in the base price of certain steel products on which would be superimposed a further temporary amount which would be removed when the retroactive wage costs were equalized. Whether or not this method will be followed remains to be seen.

It is obvious that the OPA cannot make up its mind on any overall price adjustments which it might grant until it studies the data now in the process of preparation, even though it has expressed its willingness to concede the need for price adjustments covering the time up to the recent wage award.

Another major problem which OPA must solve is what action it will take with regard to steel companies which already have been allowed to charge above ceiling prices on certain products. Whether they must continue to sell at their present above-ceiling quotations in case a general price adjustment is made or whether their above-ceiling quotations will be advanced proportionately, remains to be seen.

It is not probable that OPA will sanction a general overall price increase but rather will adopt, as it did in previous studies, a product-by-product method. Those items on which the steel companies can prove an unprofitable situation will probably be adjusted. Some special items such as armor plate and other war born products may be in for a slight decrease. It may be that those sources that looked for a speedy announcement of price adjustments are slightly overoptimistic. On the other hand it is recalled that the OPA has in its possession comprehensive price data which was furnished by the industry in 1943 and in 1944.

Number of Strikes Decline, But Time Off Increases in November

Washington

• • • There were 375 strikes in November, 1944, 200,000 workers involved and 710,000 man-days of idleness, according to the Bureau of Labor Statistics' preliminary estimates. Strike idleness was one-tenth of one per cent of the available working time.

The number of strikes and number of workers involved were somewhat less than in October, but the amount of idleness was greater. Contributing largely to this idleness were strikes at the Packard Motor Car Co., Detroit; Wright Aeronautical Corp., Paterson, N. J.; J. I. Case Co., Racine, Wis.; Ford Motor Co., Dearborn, Mich.; Wheeling Steel Corp., Portsmouth, Ohio, a strike of truck drivers in Greater Boston, and one of telephone workers in a large number of Ohio cities, Detroit and Washington, D. C.

The bureau's strike statistics include all known strikes in the continental United States which involve as many as six workers and last as long as a full day or shift. The term "strike" is used to include all stoppages of work due to labor disputes regardless of whether the workers or employers initiate or are responsible for the stoppages. As in the past, the figures include all workers in any plant who were made idle because of a strike in that plant, regardless of whether or not they were all directly involved in the dispute.

Month	Strikes beginning in month		Man-days idle in month (all strikes)	
	Number	Workers involved	Number	Per cent of available working time
November.....	375	200,000	710,000	0.10
October 1944.....	440	220,000	690,000	0.09
November 1943...	325	135,804	2,862,607	0.38
November 1942...	144	52,481	128,164	0.02
November 1941...	271	227,721	1,396,585	0.24
November 1940...	207	62,399	739,807	0.14
November 1939...	178	43,239	1,664,574	0.31

* Preliminary estimates.

Tax Relief in View For Certain Firms Under Revenue Code

Cambridge, Mass.

• • • **Many corporations are** in doubt as to the refunds they are entitled to under the excess profits tax relief section 722 of the Internal Revenue Code, particularly with regard to the cyclical provisions of the section, according to a study of these provisions by Professor Joseph L. Snider, issued recently by the Harvard Business School.

Over 30,000 corporations have already filed claims under section 722, which provides that if the earnings of a corporation during the base period 1936-1939 were depressed because the corporation and its industry were subject to a profits cycle differing materially in length and amplitude from the general business cycle, such a corporation may apply for excess profits tax relief.

"It can be readily understood," observes Professor Snider, "that taxpayers and tax practitioners are much in the dark as to the meaning of the relief provisions."

The Harvard study attempts to clarify the cyclical provisions of the law by offering conclusions on the following questions: What are cyclical fluctuations? How measure the general profits cycle? What was the condition of business in general during the 1938-1939 base period? How determine when a taxpayer's profits cycle differs materially in length and amplitude from the general cycle? How determine a taxpayer's normal earnings to be substituted for his 1936-1939 earnings in calculating his excess profits tax? What is the taxpayer's industry and what is its importance in relief claims?

"In order to justify a claim for relief on cyclical grounds the taxpayer must show that his earnings and the earnings of his industry are subject to cyclical fluctuations," the Business School study says. "This is a necessary inference from the wording of the law, but neither in the law nor the Treasury Regulations is there a definition of cyclical fluctuations.

"The presence or absence of cyclical fluctuations is best ascertained by plotting the record on a chart. In fact, if a simple chart does not reveal cyclical fluctuations, they should be presumed not to exist for purposes of section 722. If the curve on the chart shows a semblance of wave-like movements, cyclical fluctuations are probably present.

"The reason for the word 'probably' is that more than the shape of the curve is necessary to establish cyclical fluctuations. Base period earnings may look cyclically depressed on a chart and yet the low level may have been brought about by factors not cyclical in character. Cyclical factors are persistent in the experience of a company; in the words of the Treasury Regulations they are 'usual and ordinary.' Unusual conditions, whether physical or economic, may be grounds for relief but they are not cyclical grounds. To establish his case on cyclical grounds it is therefore necessary for a taxpayer to remove suspicion that his depressed condition in the base period may have been caused by unusual conditions.

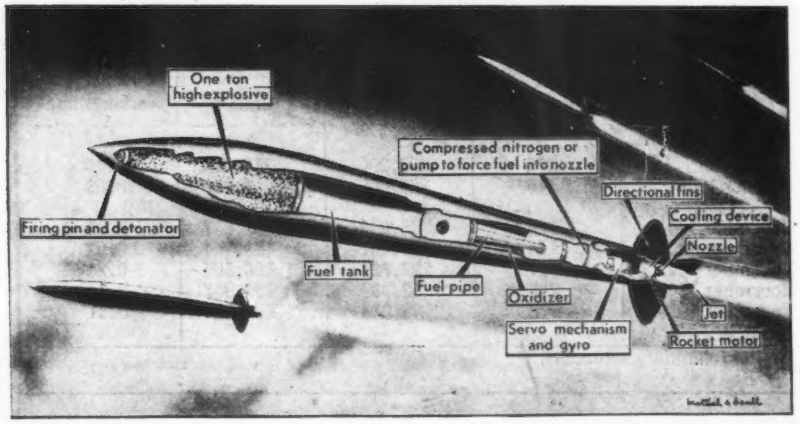
"The selection of specific measures of the general business cycle is a delicate matter, although the concept of general business is easily understood. The closer the measures of general business are to profits the better they are, because section 722 relief is applicable when the profits of the taxpayer were unfavorable in the base period compared with profits in general. It follows that measures of total sales, total production, and other measures of aggregate business activity are at most only secondary measures of the general cycle for present purposes.

"Since we are concerned with the general business cycle, the broadest possible measure of profits or earnings is essential. The best measure of earnings in general for our purposes is to be found in the data compiled by the Treasury Department from the income tax returns of corporations and published in the Treasury annual volumes on Statistics of Income.

"The data in these volumes do not give directly a satisfactory record of corporation earnings in the aggregate, but it is possible to derive satisfactory series running back a sufficiently long time." In an appendix to the study there is described the derivation of a measure of corporation earnings and of the capital of corporations in the aggregate which the author offers as satisfactory for use in connection with the relief claims.

The record of corporation earnings in the aggregate is utilized in the study to determine when the earnings of individual corporations in the period 1936-1939 should be regarded as depressed for purposes of tax relief. The author concludes that "profits in general in the period 1936-1939 were 20 per cent above the long-term average; that is, normal profits for the purpose of excess profits tax relief were 20 per cent above the long-term average."

TRUE ROCKET WEAPON: *V-2, latest of the Nazi vengeance weapons to be publicly described, is a rocket bomb powered with a liquid fuel described by some sources as compressed nitrogen, by others as a gasoline.*



J & L Buys Talon Inc.'s Tubes

Pittsburgh

• • • **The Steel Tube** Division of Talon, Inc., was purchased last week by the Jones & Laughlin Steel Corp. The plant, located at Oil City, Pa., has facilities for producing electric welded mechanical and pressure tubing in sizes from ⅝ to 4-in., O. D. inclusive and will supplement the present line of lapweld, buttweld, and seamless tubing that is marketed by Jones & Laughlin.

The new acquisition will be known as The Electric Weld Tube Division of Jones & Laughlin Steel Corp., and will be operated by present personnel.

Steel Output Reaches New High In 1944 with Wages Up and Earnings Down

BY WALTER S. TOWER, PRESIDENT
AMERICAN IRON AND STEEL INSTITUTE

New York

• • • **Successively in each** of the five years since the war began, American steel plants have broken all prior records for total steel production.

For 1944, the tonnage of steel ingots and castings produced reached a new peak estimated at 89,400,000 tons—80 per cent above our maximum year's output in the first World War and almost 1½ times the probable 1944 production in enemy Europe.

Because of declining orders in the last half of 1944, the increase over the 1943 production is not great, amounting to about 600,000 tons. The peak in production was reached during March. After that month, both orders for and production of steel declined gradually. Production in the final six months of the year was almost 700,000 tons below output in the corresponding months of 1943.

New payroll records were also established during 1944. A total of $1,700,000,000 in payrolls was paid to employees during the year, of which more than $1,400,000,000 went to wage-earning employees.

Hourly earnings likewise reached a new high figure, with wage earners during the year averaging $1.19 per hour, or 5 per cent above 1943. Weekly earnings averaged $56 during 1944, as against $49 in 1943. Those figures do not take into account any retroactive increases in pay resulting from the War Labor Board decision announced late in 1944.

Net profits of steel companies in 1944 were considerably lower than in 1943, despite higher production levels. Total earnings (after taxes) for the year will probably approximate $170,000,000, compared with $201,000,000 in 1943. In 1937, a good recent peacetime year, the steel industry netted a total of $232,000,000.

Low as the 1944 company earnings were, representing a return of less than 4.5 per cent on investment, they are certain to go lower, possibly even to the vanishing point, in 1945 unless prices are increased to compensate for the higher wages established by the labor board ruling. Prices in the industry have been frozen at 1939 levels since April, 1941, notwithstanding steadily advancing costs.

Heavy Machine Tools Moving Well at RFC Surplus Auctions

Washington

• • • **Heavy equipment** such as machine tools, including old ones, are moving well at RFC auctions of surplus property, but the lighter equipment, such as saws, hammers and construction material, is not so readily marketable. One explanation offered for this contrasting situation is that buyers are chiefly interested in heavy equipment for war production and less interested in lighter material that is principally for civilian use. It also was stated at RFC that auctions of the latter kind of material may not have been properly advertised.

Attendance at the auctions are good. Indicative of the large turnouts were those at Washington last Nov. 28, 29 and 30 when surplus property was put on the block, most of it machine tools from the Navy yard. On the first day there were about 450 present and increasing numbers on the second and third days. Buyers were chiefly industrialists who come from all sections of the country. Sizes of sales varied from $770 for a 350-ton press down to $5 for a drill.

The total value of the Washington sales was $287,000 and machine tools sold varied from 25 to 45 years in age, much of the equipment having been used in the first World War.

PIG IRON OUTPUT FALLS AGAIN: *Furnace repairs and no marked increase in demand caused November pig iron output to decline from the October level. Blast furnaces operated at 87.6 per cent of capacity in November compared with 90.0 per cent in October. The continued high level in steel output with the probability of no decline in the immediate future combined with the tightness in scrap may soon move pig iron demand to higher levels.*

Blast Furnace Capacity and Production—Net Tons

	Number of Companies	Annual Blast Furnace Capacity	PRODUCTION							
			PIG IRON		FERRO-MANGANESE AND SPIEGEL		TOTAL			
									Per Cent of Capacity	
			November	Year to Date	November	Year to Date	November	Year to Date	November	Year to Date
DISTRIBUTION BY DISTRICTS:										
Eastern	10	12,749,570	874,115	10,163,404	24,886	243,190	899,001	10,406,594	85.9	88.9
Pittsburgh-Youngstown	15	26,870,760	1,968,559	23,044,303	19,126	214,531	1,987,685	23,258,834	90.1	94.6
Cleveland-Detroit	7	6,620,500	509,216	5,711,382			509,216	5,711,382	93.7	94.2
Chicago	7	14,063,510	1,012,128	12,053,988		8,780	1,012,128	12,062,768	87.7	95.5
Southern	8	5,039,470	332,814	3,783,570	19,329	157,195	352,143	3,940,765	85.2	89.4
Western	4	2,841,100	143,838	1,560,376			143,838	1,560,376	61.7	65.9
TOTAL	35	68,184,910	4,840,670	56,317,023	63,341	623,696	4,904,011	56,940,719	87.6	92.2

During 1943 the companies included above represented 99.5% of the total blast furnace production as reported to American Iron & Steel Institute.

Brass Mill Will Be Expanded To Supply Cartridge Requirements

Cleveland

• • • **Coincident with the disclosure** that the Chase Brass & Copper Co.'s two Cleveland plants have been called upon to produce 16 million lb. of brass a month, or almost one-quarter of the Army's 70 million lb. order for small arms cartridge stripping, it was announced recently by WPB that this expansion of production schedules would necessitate an addition to Chase's DPC-owned Euclid Case plant, which will bear the brunt of the new demand.

Representing an increase of 11½ million lb. a month in the Chase quota, the new order will entail the reopening of facilities cut back last winter and the hiring of 1000 additional workers. It will unquestionably produce the largest of the urgent new manpower requirements that have lately been evidenced in this area.

WPB said final approval of plans for the addition to the Euclid Case plant would be given soon and that construction would start immediately. This new extension will house 13 more furnaces, bringing the plant's total to 33, and installation of furnaces, electrical equipment, and machinery will be completed by June, costing an estimated $3,500,000.

Board Clamps Down On Small Employer's High Wage Scales

Miami, Fla.

• • • **In an effort to curb** "flagrant wage stabilization violations," every employer in this area has been placed under new wage controls, by direction of a new order from the War Labor Board.

Regional Chairman M. T. Van Hecke said the national board had:

1. Revoked in the Miami area all exemptions from wage stabilization regulations formerly enjoyed by employers of eight or less.

2. Approved a new common labor rate of 55 cents an hour for essential industries. Most employers must obtain WLB approval of this rate, he said.

3. Reaffirmed the WLB-approved 50-cent common labor rate for nonessential industries.

The action, Van Hecke said, freezes at present levels wages paid by small employers to present employees and requires them to hire new employees at established rates under the wage stabilization program.

It also, he added:

Presages a WLB drive to bring all employers into wage stabilization compliance and prevents labor piracy by small firms which had established high wages under exemption from wage regulations, "one of the chief excuses used by larger employers who claim they have been forced to pay illegal wages to meet a 'black market' labor condition."

Van Hecke said the OPA and other agencies were making an extensive drive to curb price ceiling and rationing violations in the Miami area.

The chairman said labor members of both the regional and national board dissented to the order, roll-back of wages to the 35-cent rate.

Van Hecke said Saturday's action started with a series of conferences at Miami last October.

"At that time it was pointed out that small employers form the bulk of industry in the Miami area and that some effectual cure should be placed on their wage scales before WLB should demand that competing but larger employers should observe the letter of the wage stabilization law," he said.

Conveying Equipment Deliveries Improve

Pittsburgh

• • • **While deliveries on conveying** equipment are becoming better, especially since the shell plants throughout the country have been almost completely tooled up, conveyor machinery builders are having considerable difficulty in getting certain items of equipment that go into the construction of the various types of conveying.

The main troubles of the conveying equipment builders is in getting component parts. Alloy chain is practically impossible to obtain in quantity under six months, and deliveries on carbon steel chain are likewise slow. Among the other items that are hard to get are sprockets, bearings (ball and roller), fractional horsepower motors, all types of electrical equipment and similar items. Were it not for these items, deliveries of conveying equipment could be cut to a matter of weeks.

A sign of the times is the hasty exodus that conveyor builders are making from the metal working industry into other fields, such as foods, lumbering and farming industries and to export markets. Their activities have been so closely bound up with the war production program and the actual fighting of the war, that these markets have been neglected, both because the builders couldn't cover their needs and the consumers couldn't get orders rated high enough to insure delivery on their orders.

Now, however, with the heavy demands of the metal working industry and the fighting fronts for conveying equipment slackening off somewhat, builders are again looking to these other markets. Another plum is the export business. Already Russia has bought extensively and indications are that there is no letup in their demands.

Cost of War Items Reduced in Detroit

Detroit

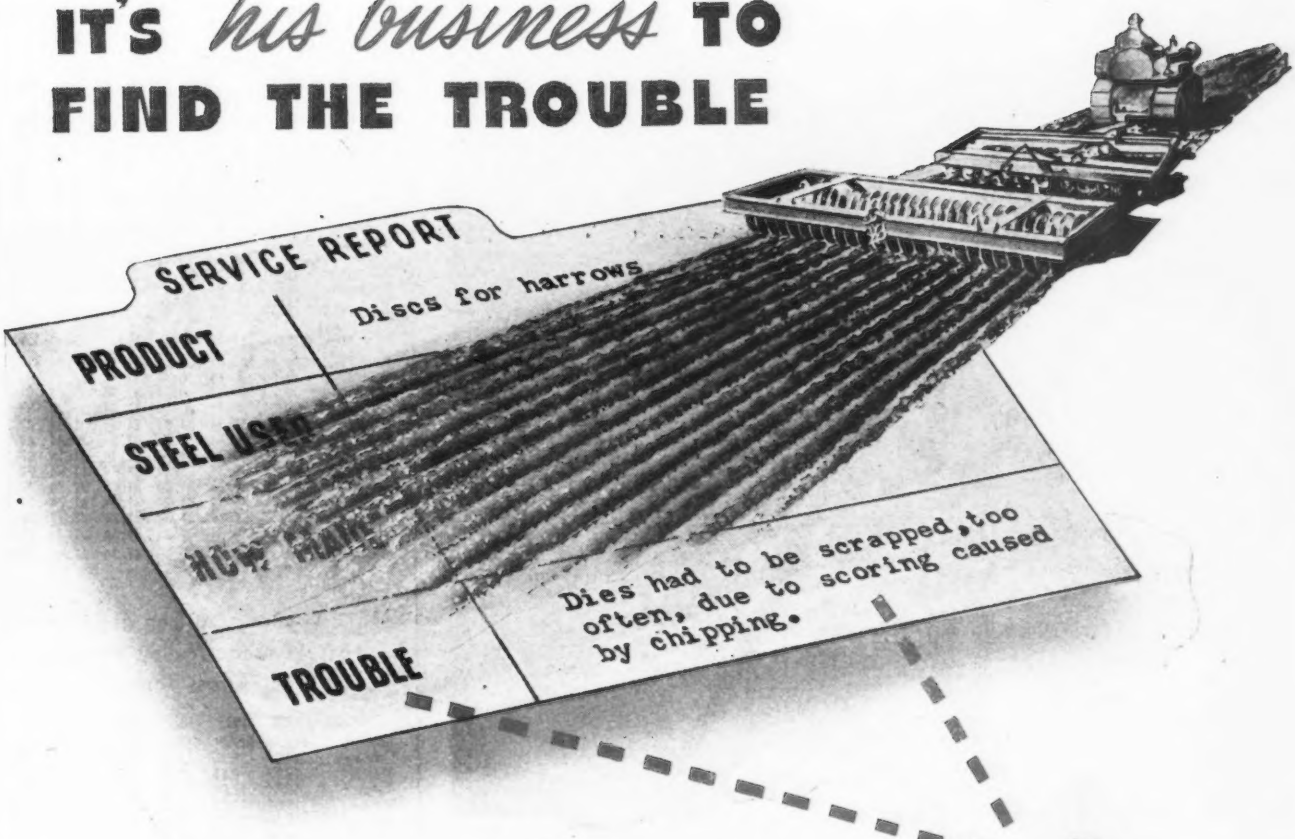
• • • **War products produced by the** automotive industry now cost just two-thirds what they did three years ago, it is indicated in figures developed by the Automotive Council for War Production.

Price reduction on guns averaged 55.8 per cent, the tabulation showed. On aircraft and components, cost reduction was 36.5 per cent; on ammunition, 31.0 per cent; on marine equipment, 31.0 per cent; and on tank and combat vehicles, 3.5 per cent. All these reductions took place during the 32-month period between January, 1942, and August, 1944.

Net savings to the armed services on automotive-produced war goods between the close of the first quarter in 1942 and the end of the third quarter this year amounted to approximately $3,111,000,000, the ACWP stated. In the third 1944 quarter alone, savings were $700,000,000.

These figures do not reflect additional cost reductions resulting from voluntary lump sum refunds by contractors or overall lump sum price reductions growing out of renegotiations by the Price Adjustment Boards.

IT'S *his business* TO FIND THE TROUBLE



The discing of the land is an important step in growing the world's food supply. The making of these discs is equally important to those whose business it is to manufacture them as economically as possible.

What has this to do with Latrobe's Metallurgical Service? Simply this: Recently, a manufacturer was confronted with a problem that involved the dies from which such discs were made. The discs were carbon steel, in the "as rolled" state, .90 to .158 thick. The dies were 18" O.D. x 16" I. D. x 4" thick. These dies were failing because of sinking, and the resultant chipping scored the dies full length, making it necessary to scrap them.

A Latrobe *Service Engineer* was called to help. After a comprehensive study of all conditions, he decided to recommend a die steel of higher compressive strength and greater toughness. The result—*25,000 pieces per grind* instead of 7,000 pieces—*and the die still in excellent condition.*

* * *

This is a typical instance of the kind of help Latrobe's Service Engineers are anxious to render to any customer. It's the business of these skilled men to know where to look for trouble . . . and what to do about it! It's a service Latrobe renders without cost, so that the products you make can be produced more efficiently and economically.

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S-1

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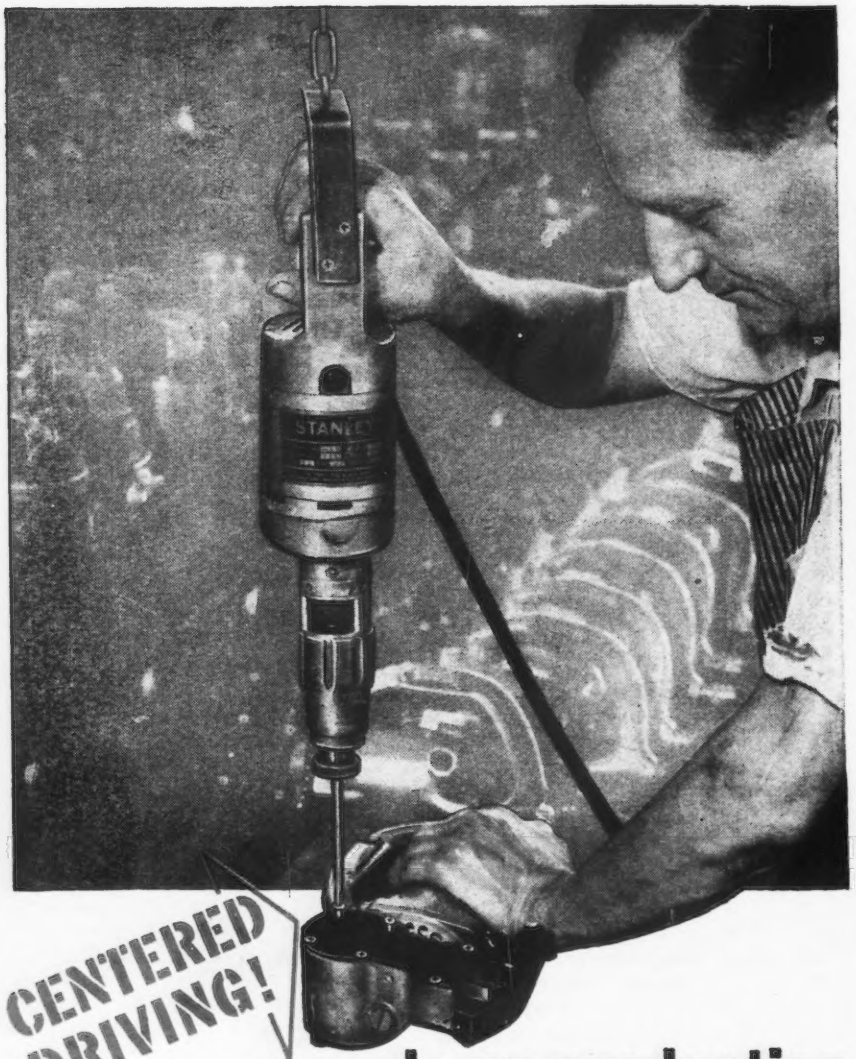
LATROBE RED ARROW for metal-cutting tools

LATROBE *Metallurgical Service*



CENTERED DRIVING!

speeds up production

Anything fastened with screws can be fastened faster, better, more economically with Corbin-Phillips Screws. Because the strong Phillips Recessed Head grips the driver in a four-point steel "center" that cannot slip. . . . Use Corbin-Phillips *Centered* Driving to speed production *safely*.

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Wood Screws, Machine Screws, Hardened Sheet Metal Screws, Self-Tapping Machine Screws, Stove Bolts. Aircraft Screws to government specifications . . .
Also — Steel Drive Screws, Lag Screws, Cap Screws, Set Screws, Hex Semi-Finished Nuts, Machine Screw Nuts, Escutcheon Pins and Chain.

THE CORBIN SCREW CORPORATION
The American Hardware Corp., Successor
NEW BRITAIN, CONN. Warehouses: New York, Chicago

CORBIN

Screws Nuts Chain

S-2

STATISTICAL

(CONTINUED FROM PAGE 121)

Lake Superior Charcoal Pig Iron, at Chicago, Gross Ton

	1933	1934	1935	1936	1937	1938
January	$23.17	$23.54	$24.04	$25.25	$26.54	$30.24
February	23.17	23.54	24.04	25.25	26.79	30.24
March	23.17	23.54	24.04	25.25	29.44	30.24
April	23.17	24.79	24.13	25.25	30.04	30.32
May	23.17	24.04	24.25	25.25	30.04	30.34
June	23.17	24.04	24.25	25.25	30.04	30.34
July	23.17	24.04	24.25	25.25	30.04	28.34
August	23.17	24.04	24.25	25.25	30.04	28.34
September	23.67	24.04	24.25	25.25	30.04	28.34
October	23.54	24.04	24.85	25.25	30.04	28.34
November	23.54	24.04	25.25	25.50	30.16	28.34
December	23.54	24.04	25.25	26.25	30.24	28.34
Average	23.30	23.98	24.35	25.35	29.45	29.31

	1939	1940	1941	1942	1943	1944
January	$28.34	$30.34	$30.34	$31.34	$31.34	$37.34
February	28.34	30.34	30.34	31.34	31.34	37.34
March	28.34	30.34	30.34	31.34	31.34	37.34
April	28.34	30.34	30.34	31.34	31.34	37.34
May	28.34	30.34	31.09	31.34	31.34	37.34
June	28.34	30.34	31.34	31.34	31.34	37.34
July	28.34	30.34	31.34	31.34	31.34	37.34
August	28.34	30.34	31.34	31.34	31.34	37.34
September	29.34	30.34	31.34	31.34	37.34	37.34
October	30.34	30.34	31.34	31.34	37.34	37.34
November	30.34	30.34	31.34	31.34	37.34	37.34
December	30.34	30.34	31.34	31.34	37.34	37.34
Average	28.92	30.34	30.99	31.34	37.34	37.34

No. 2 Foundry Pig Iron at Mahoning or Shenango Valley Furnace, Gross Ton

	1929	1931	1932	1933	1934	1935
January	$17.50	$17.00	$15.50	$14.50	$17.50	$18.50
February	17.50	16.75	15.12	14.50	17.50	18.50
March	17.75	16.50	15.00	14.50	17.50	18.50
April	18.00	17.00	15.00	14.50	17.75	18.50
May	18.50	17.00	14.70	14.70	18.50	18.50
June	18.50	17.00	14.50	15.50	18.50	18.50
July	18.50	17.00	14.50	16.00	18.50	18.50
August	18.50	17.00	14.50	16.70	18.50	18.50
September	18.50	17.00	14.50	17.50	18.50	18.50
October	18.50	16.63	14.50	17.50	18.50	18.50
November	18.50	16.00	14.50	17.50	18.50	19.50
December	18.50	15.70	14.50	17.50	18.50	19.50
Average	18.23	16.72	14.73	15.91	18.19	18.87

	1936	1937	1938	1939	1940	
January	$19.50	$21.00	$24.00	$21.00	$23.00	1944
February	19.50	21.25	24.00	21.00	23.00	1943
March	19.50	23.60	24.00	21.00	23.00	1942
April	19.50	24.00	24.00	21.00	23.00	1941
May	19.50	24.00	24.00	21.00	23.00	price
June	19.50	24.00	23.20	21.00	23.00	fixed
July	19.50	24.00	20.00	21.00	23.00	at
August	19.50	24.00	20.00	21.00	23.00	$24.00
September	19.50	24.00	20.25	22.00	23.00	
October	19.50	24.00	21.00	23.00	23.00	
November	19.75	24.00	21.00	23.00	23.00	
December	20.50	24.00	21.00	23.00	23.40	
Average	19.60	23.49	22.20	21.59	23.03	

No. 2 Foundry Pig Iron at Chicago Furnace, Gross Ton

	1929	1931	1932	1933	1934	1935
January	$20.00	$17.50	$16.50	$15.50	$17.50	$18.50
February	20.00	17.50	16.50	15.50	17.50	18.50
March	20.00	17.50	16.50	15.50	17.50	18.50
April	20.00	17.50	16.00	15.50	17.75	18.50
May	20.00	17.50	16.00	15.80	18.50	18.50
June	20.00	17.50	16.00	16.00	18.50	18.50
July	20.00	17.50	15.50	16.78	18.50	18.50
August	20.00	17.50	15.50	17.10	18.50	18.50
September	20.00	17.50	15.50	17.50	18.50	18.50
October	20.00	17.00	15.50	17.50	18.50	18.70
November	20.00	17.00	15.50	17.50	18.50	19.50
December	20.00	16.70	15.50	17.50	18.50	19.50
Average	20.00	17.35	15.87	16.47	18.19	18.88

	1936	1937	1938	1939	1940	
January	$19.50	$21.00	$24.00	$21.00	$23.00	1944
February	19.50	21.25	24.00	21.00	23.00	1943
March	19.50	23.60	24.00	21.00	23.00	1942
April	19.50	24.00	24.00	21.00	23.00	1941
May	19.50	24.00	24.00	21.00	23.00	price
June	19.50	24.00	23.20	21.00	23.00	fixed
July	19.50	24.00	20.00	21.00	23.00	at
August	19.50	24.00	20.00	21.00	23.00	$24.00
September	19.50	24.00	20.25	22.00	23.00	
October	19.50	24.00	21.00	23.00	23.00	
November	19.75	24.00	21.00	23.00	23.00	
December	20.50	24.00	21.00	23.00	23.40	
Average	19.60	23.49	22.20	21.59	23.03	

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Constantly tested, constantly improved—Chicago Wheels produce finishes so perfect they pass exacting surface analyzer tests, so accurate they can be measured in micro inches.

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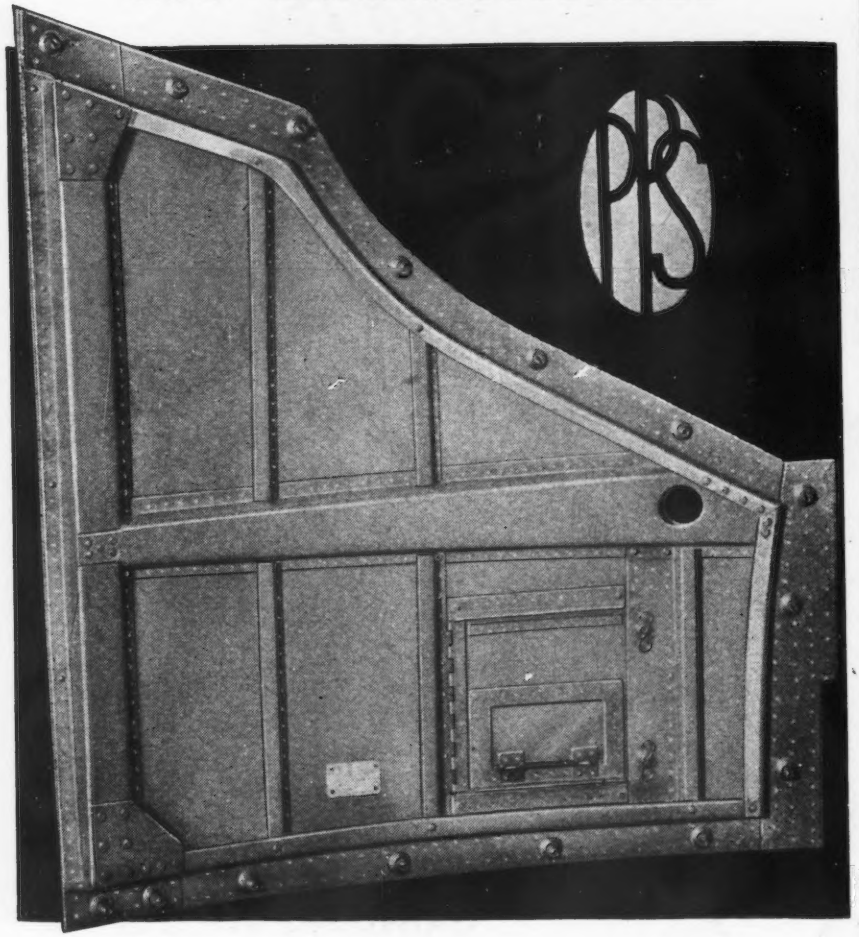

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Subsidiary of SPICER MFG. CORP., READING, PA.

Western Representative: F. Somers Peterson, 57 California St., San Francisco, Calif.

No. 2 Foundry Pig Iron at Granite City, Ill.,* Furnace, Gross Ton

	1929	1931	1932	1933	1934	1935
January	$20.75	$18.25	$18.33	$18.33	$17.50	$18.50
February	20.75	18.25	18.33	18.33	17.50	18.50
March	20.75	18.25	18.33	18.33	17.50	18.50
April	20.75	18.25	18.33	17.34	17.75	18.50
May	20.75	18.25	18.33	16.55	18.50	18.50
June	20.75	18.25	18.33	16.85	18.50	18.50
July	20.75	18.25	18.33	17.35	18.50	18.50
August	20.69	18.25	18.33	17.85	18.50	18.50
September	20.50	18.25	18.33	17.50	18.50	18.50
October	20.50	18.25	18.33	17.50	18.50	18.70
November	20.50	18.25	18.33	17.50	18.50	19.50
December	20.50	18.25	18.33	17.50	18.50	19.50
Average	20.66	18.25	18.33	17.58	18.19	18.68

	1936	1937	1938	1939	1940	
January	$19.50	$21.00	$24.00	$21.00	$23.00	1944
February	19.50	21.25	24.00	21.00	23.00	1943
March	19.50	23.60	24.00	21.00	23.00	1942
April	19.50	24.00	24.00	21.00	23.00	1941
May	19.50	24.00	24.00	21.00	23.00	price
June	19.50	24.00	23.00	21.00	23.00	fixed
July	19.50	24.00	20.00	21.00	23.00	at
August	19.50	24.00	20.00	21.00	23.00	$24.00
September	19.50	24.00	20.25	22.00	23.00	
October	19.50	24.00	21.00	23.00	23.00	
November	19.75	24.00	21.00	23.00	23.00	
December	20.50	24.00	21.00	23.00	23.50	
Average	19.60	23.49	22.20	21.59	23.04	

* Prior to Sept. 1933, St. Louis prices are given

No. 2 Foundry Pig Iron at Buffalo Furnace, Gross Ton

	1929	1931	1932	1933	1934	1935
January	$18.00	$17.50	$16.00	$16.00	$17.50	$18.50
February	18.39	17.50	16.00	16.00	17.50	18.50
March	18.50	17.50	16.00	16.00	17.50	18.50
April	18.50	17.50	16.00	16.00	17.50	18.50
May	18.50	17.13	16.00	16.00	18.50	18.50
June	18.75	17.00	16.00	16.00	18.50	18.50
July	19.50	17.00	16.00	16.50	18.50	18.50
August	19.50	17.00	16.00	17.10	18.50	18.50
September	19.50	17.00	16.00	17.50	18.50	18.50
October	19.50	17.00	16.00	17.50	18.50	18.50
November	19.50	17.00	16.00	17.50	18.50	19.50
December	19.50	16.80	16.00	17.50	18.50	19.50
Average	18.97	17.16	16.00	16.63	18.17	18.67

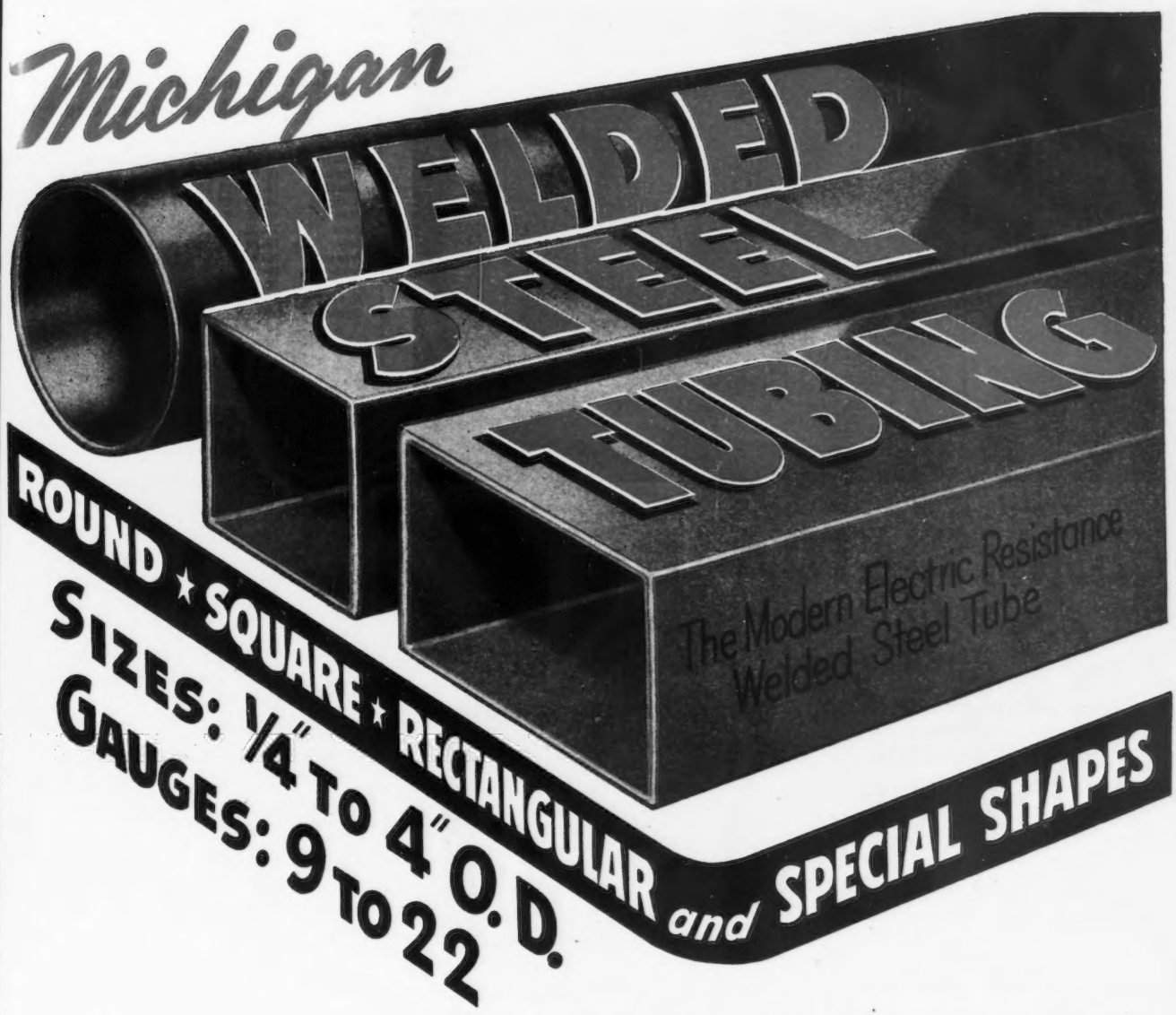
	1936	1937	1938	1939	1940	
January	$19.50	$21.00	$24.00	$21.00	$23.00	1944
February	19.50	21.25	24.00	21.00	23.00	1943
March	19.50	23.60	24.00	21.00	23.00	1942
April	19.50	24.00	24.00	21.00	23.00	1941
May	19.50	24.00	24.00	21.00	23.00	price
June	19.50	24.00	23.20	21.00	23.00	fixed
July	19.50	24.00	20.00	21.00	23.00	at
August	19.50	24.00	20.00	21.00	23.00	$24.00
September	19.50	24.00	20.13	22.00	23.00	
October	19.50	24.00	20.88	23.00	23.00	
November	19.75	24.00	21.00	23.00	23.00	
December	20.50	24.00	21.00	23.00	23.40	
Average	19.60	23.49	22.18	21.59	23.03	

Southern No. 2 Foundry Pig Iron at Birmingham, Gross Ton

	1929	1932	1933	1934	1935	1936
January	$16.50	$11.50	$11.00	$13.50	$14.50	$15.50
February	16.50	11.00	11.00	13.50	14.50	15.50
March	16.00	11.00	11.00	13.50	14.50	15.50
April	15.40	11.00	11.25	13.50	14.50	15.50
May	15.00	11.00	12.00	14.30	14.50	15.50
June	15.00	11.00	12.00	14.50	14.50	15.50
July	14.63	11.00	12.50	14.50	14.50	15.50
August	14.50	11.00	13.10	14.50	14.50	15.88
September	14.50	11.00	13.50	14.50	14.50	15.88
October	14.50	11.00	13.50	14.50	14.50	15.88
November	14.50	11.00	13.50	14.50	14.75	16.13
December	14.50	11.00	13.50	14.50	15.50	16.88
Average	15.13	11.04	12.32	14.15	14.60	15.76

	1937	1938	1939	1940	1941	
January	$17.38	$20.38	$17.38	$19.38	$19.38	1944
February	17.63	20.38	17.38	19.38	19.38	1943
March	19.98	20.38	17.38	19.38	19.89	1942
April	20.38	20.38	17.38	19.38	20.38	price
May	20.38	20.38	17.38	19.38	20.38	fixed
June	20.38	19.58	17.38	19.38	20.38	at
July	20.38	18.38	17.38	19.38	20.38	$20.38
August	20.38	16.38	17.38	19.38	20.38	
September	20.38	16.63	18.38	19.38	20.38	
October	20.38	17.38	19.38	19.38	20.38	
November	20.38	17.38	19.38	19.38	20.38	
December	20.38	17.38	19.38	19.38	20.38	
Average	19.87	18.58	17.96	19.38	20.17	

* 38c. a ton deducted for 0.70 phosphorus and over.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SEMISILICA BRICKS

DURATION OF HEAT AFFECTS REFRACTORIES

Following statements are based on temperature range from 2200° F to 2700° F.

SHORT DURATIONS OF HEAT

Furnaces with daily or shorter firing cycles usually require a good clay or super duty brick.

MODERATE DURATIONS OF HEAT

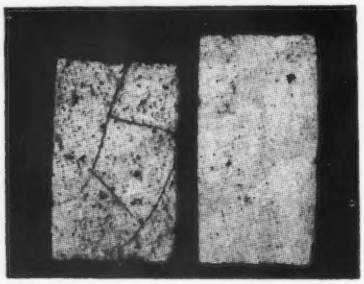
Furnaces with firing cycles of days, weeks or months require refractories which will not vitrify, shrink or spall, from the prolonged heats.

RM SEMISILICA BRICKS are made for this service. The picture at the right shows the results of 24 hours at 2650° F. on a First Quality Clay Brick and the almost unaffected RM.

LONG DURATIONS OF HEAT

Furnaces, intended to be run continuously can safely be lined with RM SEMISILICA BRICKS, provided the face temperature of the lining is below 2700° F. While silica bricks are ideal for continuous heats, a furnace may have to be shut down, which is hard on Silica Bricks, but RM SEMISILICA BRICKS take it easily.

Note. Some slags and gases attack refractories, so if in doubt, please ask or write for recommendation for your furnaces.



Compression, vitrification and spalling of First Quality Clay Brick, and relatively unaffected RM Semisilica brick after a run of 24 hours under heat and load.

In STEEL MILLS:

For Heating, Reheating, Annealing and Heat Treating Furnaces, OH Regenerators, Blast Furnace Stoves, Soaking Pits, etc. In the roofs, where spalling failure is most prevalent, they perform their greatest service.

In MANY INDUSTRIES:

Such as Chemical, Ceramic, Zinc Smelting and other industries where continuous heats in the temperature range of RM's are required for their processes.

RICHARD C. REMMEY SON CO.

PHILADELPHIA 37, PA.

REMMEY

STATISTICAL

Basic Pig Iron at Mahoning or Shenango Valley Furnace, Gross Ton

	1936	1937	1938	1939	1940	
January	$19.00	$20.50	$23.50	$20.50	$22.50	1944
February	19.00	20.75	23.50	20.50	22.50	1943
March	19.00	23.10	23.50	20.50	22.50	1942
April	19.00	23.50	23.50	20.50	22.50	1941
May	19.00	23.50	23.50	20.50	22.50	price
June	19.00	23.50	22.70	20.50	22.50	fixed
July	19.00	23.50	19.50	20.50	22.50	at
August	19.00	23.50	19.50	20.50	22.50	$23.50
September	19.00	23.50	19.75	21.50	22.50	
October	19.00	23.50	20.50	22.50	22.50	
November	19.25	23.50	20.50	22.50	22.50	
December	20.00	23.50	20.50	22.50	22.90	
Average	19.10	22.99	21.70	21.09	22.53	

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Standard Steel Pipe at Pittsburgh, Net Ton

Computed from list discounts, for carload lots; price for base size pipe, 1 to 3 in.; ¾ to 3 in. prior to April 13, 1931.

	1928	1929	1930	1931	1932	1933
January	$68.60	$70.30	$70.30	$66.50	$64.84	$65.00
February	68.60	70.30	70.30	66.50	64.84	65.00
March	68.60	70.30	70.30	66.50	64.84	65.00
April	69.88	70.30	66.50	66.50	64.84	58.00
May	70.30	70.30	66.50	63.59	64.84	58.00
June	70.30	70.30	66.50	64.84	64.84	58.00
July	70.30	70.30	66.50	64.84	64.84	61.75
August	70.30	70.30	66.50	64.84	64.84	61.75
September	70.30	70.30	66.50	64.84	65.00	61.75
October	70.30	70.30	66.50	64.84	65.00	61.75
November	70.30	70.30	66.50	64.84	65.00	61.75
December	70.30	70.30	66.50	64.84	65.00	61.75
Average	69.84	70.30	67.45	65.29	64.89	61.63

	1934	1935	1936	1937	1938	
January	$61.75	$68.40	$68.40	$61.00	$71.00	1944
February	61.75	68.40	64.98	61.00	71.00	1943
March	61.75	68.40	61.80	69.00	71.00	1942
April	63.41	68.40	61.00	71.00	71.00	1941
May	68.40	68.40	61.00	71.00	71.00	1940
June	68.40	68.40	61.00	71.00	71.00	1939
July	68.40	68.40	61.00	71.00	63.00	price
August	68.40	68.40	61.00	71.00	63.00	fixed
September	68.40	68.40	61.00	71.00	63.00	at
October	68.40	68.40	61.00	71.00	63.00	$63.00
November	68.40	68.40	61.00	71.00	63.00	
December	68.40	68.40	61.00	71.00	63.00	
Average	66.32	68.40	62.01	69.17	67.00	

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High Speed Tool Steel Base Per Pound, Cents

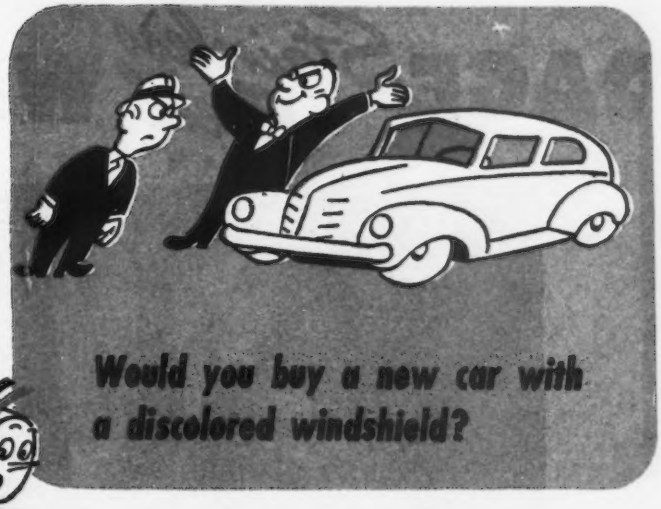
	1937	
January	80.00	1944
February	67.00	1943
March	67.00	1942
April	67.00	1941
May	67.00	1940
June	67.00	1939
July	67.00	1938
August	67.00	price
September	80.00	fixed
October	80.00	at
November	80.00	67.00
December	80.00	
Average	70.10	

•

Stainless Steel Sheets No. 304 Base Per Pound, Cents

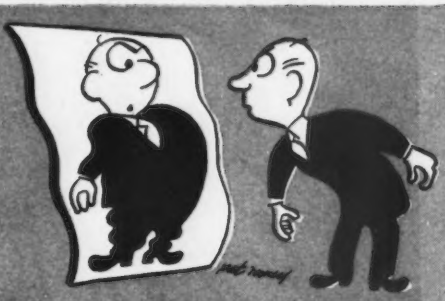
	1937	
January	35.00	1944
February	35.00	1943
March	36.00	1942
April	36.00	1941
May	36.00	1940
June	36.00	1939
July	36.00	1938
August	36.00	price
September	36.00	fixed
October	36.00	at
November	36.00	36.00
December	36.00	
Average	35.90	

"Filmonize" Transparent Tape is Transparent



Would you buy a new car with a discolored windshield?

Would you buy war stockings if you could get nylons?



Would you buy a distorting mirror?

Clear as spring water—you can see right through to the core—that's "FILMONIZE" Transparent TAPE!

We welcome comparisons. Take a yard or a roll of "FILMONIZE" Transparent TAPE, place it beside the TAPE you now use and you'll see the difference. "FILMONIZE" SELF-SEALING TAPE speaks for itself.

Call your local distributor for a demonstration today. He can deliver "FILMONIZE" SELF-SEALING TAPE in quantity for all industrial or commercial uses.

FILMONIZE SETS NEW STANDARDS

- Easy to use . . . strips easily from roll.
- No "curl-back" . . no tangle . . no waste.
- Seals without water.
- Widths from ½" to 18" throughout the "FILMONIZE" line.

Filmonize
TRADE MARK REG
SELF-SEALING TAPES

INTERNATIONAL PLASTIC CORPORATION
MORRISTOWN, NEW JERSEY

PAGE *Stainless Steel* WIRE

● "*Use Stainless Steel Wire*" may be the answer to your problem of "how to make it" or "how to speed production" or "how to cut costs."

Since the early days of Stainless Steel, **PAGE** has been drawing Stainless wire to meet just such production problems. So that today, **PAGE** has not only the know-how of working with Stainless Steel, but also long experience in the application of specially-shaped Stainless Wire to the manufacture of other products.

Maybe a new way to use a special Stainless Steel Shaped wire would solve a problem of yours. If there is a possibility, it will pay you to

Get in touch with Page!

PAGE STEEL AND WIRE DIVISION

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AMERICAN CHAIN & CABLE COMPANY, INC.

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In Business for Your Safety

STATISTICAL

Plates at Pittsburgh, Cents a Pound

	1928	1929	1930	1931	1932	1933
January	1.81	1.90	1.83	1.64	1.50	1.60
February	1.85	1.90	1.80	1.65	1.50	1.60
March	1.85	1.90	1.80	1.65	1.52	1.60
April	1.85	1.95	1.80	1.65	1.60	1.55
May	1.85	1.95	1.73	1.65	1.60	1.50
June	1.85	1.95	1.69	1.65	1.60	1.53
July	1.85	1.95	1.65	1.63	1.60	1.60
August	1.90	1.95	1.61	1.60	1.60	1.60
September	1.90	1.95	1.60	1.60	1.60	1.60
October	1.90	1.94	1.60	1.60	1.60	1.70
November	1.90	1.90	1.60	1.60	1.60	1.70
December	1.90	1.90	1.60	1.54	1.60	1.70
Average	1.87	1.93	1.69	1.62	1.57	1.61

	1934	1935	1936	1937	1938	1944
January	1.70	1.80	1.80	2.05	2.25	1943
February	1.70	1.80	1.80	2.05	2.25	1942
March	1.70	1.80	1.80	2.21	2.25	1941
April	1.74	1.80	1.80	2.25	2.25	1940
May	1.85	1.80	1.80	2.25	2.25	1939
June	1.85	1.80	1.80	2.25	2.22	price
July	1.81	1.80	1.90	2.25	2.10	fixed
August	1.80	1.80	1.90	2.25	2.10	at
September	1.80	1.80	1.90	2.25	2.10	2.10
October	1.80	1.80	1.90	2.25	2.10	
November	1.80	1.80	1.90	2.25	2.10	
December	1.80	1.80	1.90	2.25	2.10	
Average	1.78	1.80	1.85	2.21	2.17	

Hot-Rolled Sheets at Pittsburgh, Cents a Pound

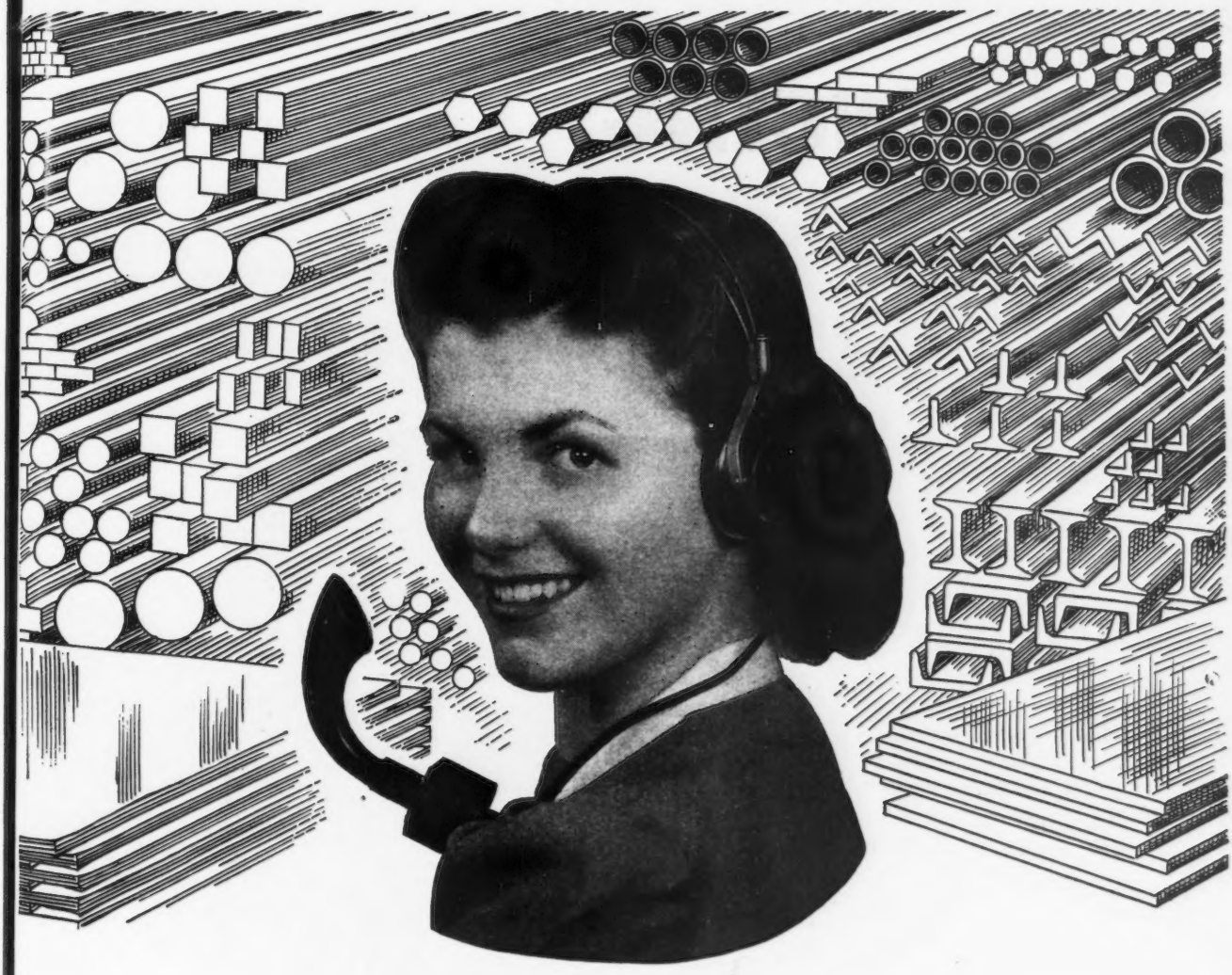
	1929	1931	1932	1933	1934	1935
January	2.10	1.90	1.75	1.62	1.75	1.85
February	2.10	1.90	1.75	1.60	1.75	1.85
March	2.10	1.90	1.71	1.55	1.75	1.85
April	2.10	1.85	1.70	1.55	1.81	1.85
May	2.13	1.85	1.70	1.44	2.00	1.85
June	2.20	1.85	1.70	1.50	2.00	1.85
July	2.14	1.85	1.70	1.65	1.88	1.85
August	2.10	1.85	1.70	1.65	1.85	1.85
September	2.10	1.85	1.70	1.68	1.85	1.85
October	2.10	1.85	1.70	1.75	1.85	1.85
November	2.10	1.85	1.70	1.75	1.85	1.85
December	2.18	1.80	1.70	1.75	1.85	1.85
Average	2.12	1.88	1.71	1.62	1.85	1.85

	1936	1937	1938	1939	1940	1944
January	1.85	2.15	2.40	2.15	2.10	1943
February	1.85	2.15	2.40	2.15	2.10	1942
March	1.85	2.35	2.40	2.15	2.10	1941
April	1.85	2.40	2.40	2.15	2.10	price
May	1.85	2.40	2.38	2.08	1.98	fixed
June	1.87	2.40	2.27	2.00	2.10	at
July	1.95	2.40	2.15	2.00	2.10	2.10
August	1.95	2.40	2.15	2.00	2.10	
September	1.95	2.40	2.15	2.00	2.10	
October	1.95	2.40	2.03	2.00	2.10	
November	1.95	2.40	2.15	2.02	2.10	
December	2.15	2.40	2.15	2.10	2.10	
Average	1.92	2.35	2.25	2.06	2.09	

Cold-Rolled Sheets at Pittsburgh, Cents a Pound

	1929	1931	1932	1933	1934	1935
January	4.10	3.30	2.90	2.35	2.75	2.95
February	4.10	3.90	2.80	2.25	2.75	2.95
March	4.10	3.24	2.86	2.30	2.75	2.95
April	4.10	3.10	2.90	2.30	2.85	2.95
May	4.10	3.03	2.89	2.34	3.15	2.95
June	4.10	3.02	2.85	2.29	3.15	2.95
July	4.10	3.10	2.85	2.40	2.99	2.95
August	4.08	3.10	2.81	2.47	2.95	2.95
September	4.00	3.10	2.75	2.75	2.95	2.95
October	4.00	3.10	2.65	2.75	2.95	2.95
November	4.00	3.10	2.63	2.75	2.95	2.95
December	3.98	3.02	2.65	2.75	2.95	2.95
Average	4.06	3.13	2.80	2.48	2.96	2.95

	1936	1937	1938	1939	1940	1944
January	2.95	3.25	3.55	3.20	3.05	1943
February	2.95	3.25	3.50	3.20	3.05	1942
March	2.95	3.49	3.45	3.20	3.05	1941
April	2.95	3.55	3.45	3.20	2.93	price
May	2.95	3.55	3.43	3.11	3.05	fixed
June	2.95	3.55	3.32	3.05	3.05	at
July	3.05	3.55	3.20	3.05	3.05	3.05
August	3.05	3.55	3.20	3.05	3.05	
September	3.05	3.55	3.20	3.05	3.05	
October	3.05	3.55	3.08	3.05	3.05	
November	3.05	3.55	3.20	3.05	3.05	
December	3.25	3.55	3.20	3.05	3.05	
Average	3.02	3.49	3.31	3.10	3.04	



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Every type of steel from stainless to structurals is immediately available from Ryerson stock. Just reach for the phone and call any one of the eleven conveniently-located Ryerson service plants. Ou · operators will connect you at once with an experienced service man who will see that you get the steel you need—when you need it.

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Steel Service Plants: Chicago, Milwaukee, Detroit, St. Louis, Cincinnati, Cleveland, Pittsburgh, Philadelphia, Buffalo, New York, Boston.

QUICK, DEPENDABLE SHIPMENT

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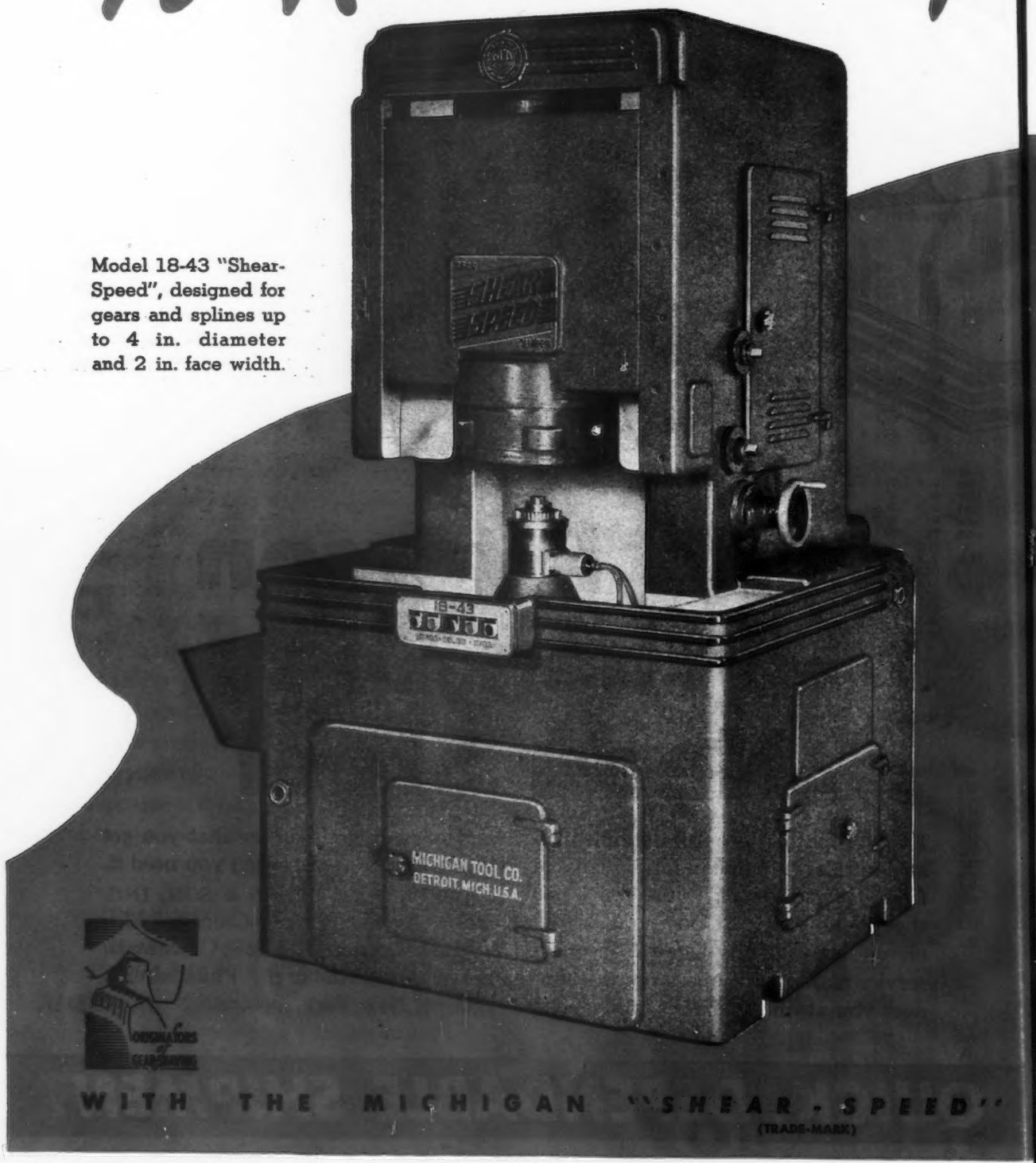
A Revolutionary



Model 18-43 "Shear-Speed", designed for gears and splines up to 4 in. diameter and 2 in. face width.

WITH THE MICHIGAN "SHEAR-SPEED" (TRADE-MARK)

New Method of
GEAR CUTTING

Designed for quantity production of gears, the Michigan "Shear-Speed" represents the first major advance in almost half a century in the roughing and semi-finishing of spur gears, helical gears, straightside splines, involute splines, shoulder gears, etc.—all of which the "Shear-Speed" will handle interchangeably.

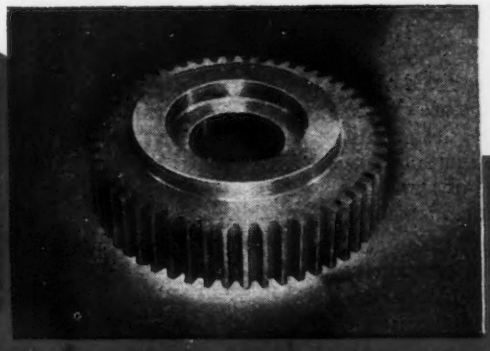
It represents the fastest, lowest cost method of cutting such gears ever developed. One "Shear-Speed" machine will rough cut all the gears that can be shaved on a rack-shaver—i. e. from 60 to 100 pieces per hour.

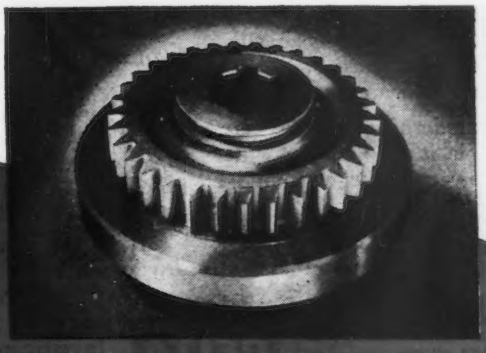
With the "Shear-Speed", all teeth of the gear are cut simultaneously. Cutting pressures are balanced in all directions, assuring concentricity. Correct spacing and form, built into the tooling, is virtually independent of machine action. Tool sharpening is extremely simple.

Shear-cutting action gives fine finish, eliminates undercut at root in gears and splines. Cutter head assemblies are installed and removed as a unit.

The "Shear-Speed" is easier to load. No arbors or nuts to worry about. Safer to operate. Easier to maintain. Automatic in operation.

Ask for Bulletin SS-44





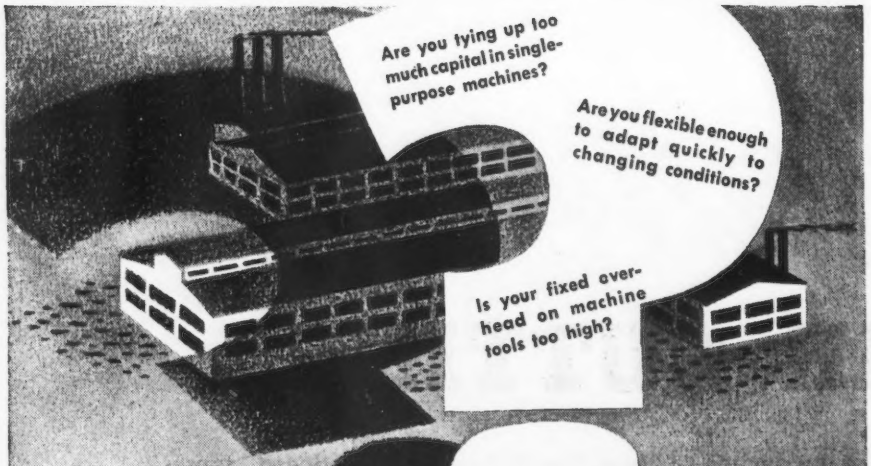
(*Above Left*) It takes less than 1 minute to cut this 4 in. diameter, 1 in. face width, 51 tooth gear by the "Michigan" method.

(*Above*) Shoulder gears like this are no problem to the "Shear-Speed". It will turn them out just as fast as other types.

(*Left*) Helical gears can also be cut on the new Michigan "Shear-Speed" gear shaper.

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS ROAD DETROIT 12, U. S. A.


Are you tying up too much capital in single-purpose machines?
Are you flexible enough to adapt quickly to changing conditions?
Is your fixed overhead on machine tools too high?

Cut Your Investment Risk in Post-war Retooling..

with flexible, low-cost Delta-Milwaukee Machine Tools

War production experience proves you can maintain volume and quality — with big savings . . .

With portable, compact Delta-Milwaukee Machine Tools you can revise production line layouts at will, to get the best sequence of operations for increased man-hour output.

You can modernize obsolete machines by replacing worn units with standard, low-cost Delta components.

And you can build high-production, special-purpose machines — that can be quickly converted to other uses, when changing conditions warrant—out of regular stock-model Delta elements.

By cutting down your fixed investment, you retain more liquid working capital for other post-war needs . . . and you reduce fixed overhead. Delta cost savings are due to a new conception of tool design and to modern production methods applied to a large volume of standard models—not to short-cuts in quality.

Avoid the unnecessary delay and investment risk of buying costly, cumbersome, inflexible machines . . . with Delta tools. Investigate! MA-15

Below: An efficient, low-cost tube polishing machine, built by mounting two Delta Abrasive Belt Finishing Machines face to face on one stand. The tube is fed in oh an angle and the action of the abrasive belt polishes and feeds the tube.

DELTA MILWAUKEE Machine Tools

Delta's 76-page Blue Book provides 140 case histories of valuable war production experience that may suggest similar money-saving peacetime applications in your plant. Also available is a catalog of low-cost Delta-Milwaukee Machine Tools. Request both, using coupon below. ***Tear out and mail today!***

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STATISTICAL

Hot-Rolled Strip at Pittsburgh, Cents a Pound

	1929	1931	1932	1933	1934	1935
January	1.80	1.55	1.41	1.45	1.75	1.85
Febrary	1.80	1.55	1.40	1.45	1.75	1.85
March	1.80	1.55	1.40	1.45	1.75	1.85
April	1.90	1.55	1.40	1.45	1.81	1.85
May	1.90	1.55	1.40	1.49	2.00	1.85
June	1.90	1.55	1.41	1.55	2.00	1.85
July	1.90	1.55	1.45	1.60	1.88	1.85
August	1.90	1.55	1.45	1.64	1.85	1.85
September	1.97	1.55	1.45	1.68	1.85	1.85
October	1.90	1.54	1.45	1.75	1.85	1.85
November	1.90	1.50	1.45	1.75	1.85	1.85
December	1.90	1.49	1.45	1.75	1.85	1.85
Average	1.88	1.54	1.43	1.58	1.85	1.85

	1936	1937	1938	1939	1940	1944
January	1.85	2.15	2.40	2.15	2.10	1943
February	1.85	2.15	2.40	2.15	2.10	1942
March	1.85	2.35	2.40	2.15	2.10	1941
April	1.85	2.40	2.40	2.15	1.98	price
May	1.85	2.40	2.38	2.06	2.10	fixed
June	1.85	2.40	2.27	2.00	2.10	at
July	1.95	2.40	2.15	2.00	2.10	2.10
August	1.95	2.40	2.15	2.00	2.10	
September	1.95	2.40	2.15	2.00	2.10	
October	1.95	2.40	2.03	2.00	2.10	
November	1.95	2.40	2.15	2.02	2.10	
December	2.11	2.40	2.15	2.10	2.10	
Average	1.91	2.35	2.25	2.06	2.09	

Cold-Rolled Strip at Pittsburgh, Cents a Pound

	1929	1931	1932	1933	1934	1935
January	2.85	2.25	1.92	1.88	2.40	2.60
February	2.85	2.25	1.90	1.80	2.40	2.60
March	2.80	2.25	1.96	1.80	2.40	2.60
April	2.75	2.23	2.00	1.80	2.50	2.60
May	2.75	2.15	2.00	1.88	2.80	2.60
June	2.75	2.15	2.00	2.00	2.80	2.60
July	2.75	2.15	2.00	2.19	2.64	2.60
August	2.75	2.15	2.00	2.25	2.60	2.60
September	2.75	2.15	1.92	2.29	2.60	2.60
October	2.75	2.13	1.90	2.40	2.60	2.60
November	2.75	2.05	2.00	2.40	2.60	2.60
December	2.75	2.03	2.00	2.40	2.60	2.60
Average	2.77	2.16	1.97	2.09	2.58	2.60

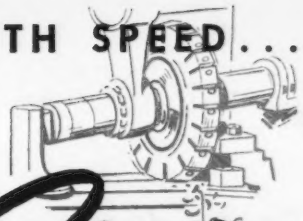
	1936	1937	1938	1939	1940	1944
January	2.60	2.85	3.20	2.95	2.80	1943
February	2.60	2.85	3.20	2.95	2.80	1942
March	2.60	3.13	3.20	2.95	2.80	1941
April	2.60	3.20	3.20	2.95	2.68	price
May	2.60	3.20	3.18	2.86	2.80	fixed
June	2.60	3.20	3.07	2.80	2.80	at
July	2.60	3.20	2.98	2.80	2.80	2.80
August	2.60	3.20	2.95	2.80	2.80	
September	2.60	3.20	2.95	2.80	2.80	
October	2.60	3.20	2.83	2.80	2.80	
November	2.60	3.20	2.95	2.80	2.80	
December	2.80	3.20	2.95	2.80	2.80	
Average	2.62	3.14	3.05	2.86	2.79	

No. 24 Gage Galvanized Sheets, at Pittsburgh, Cents a Pound

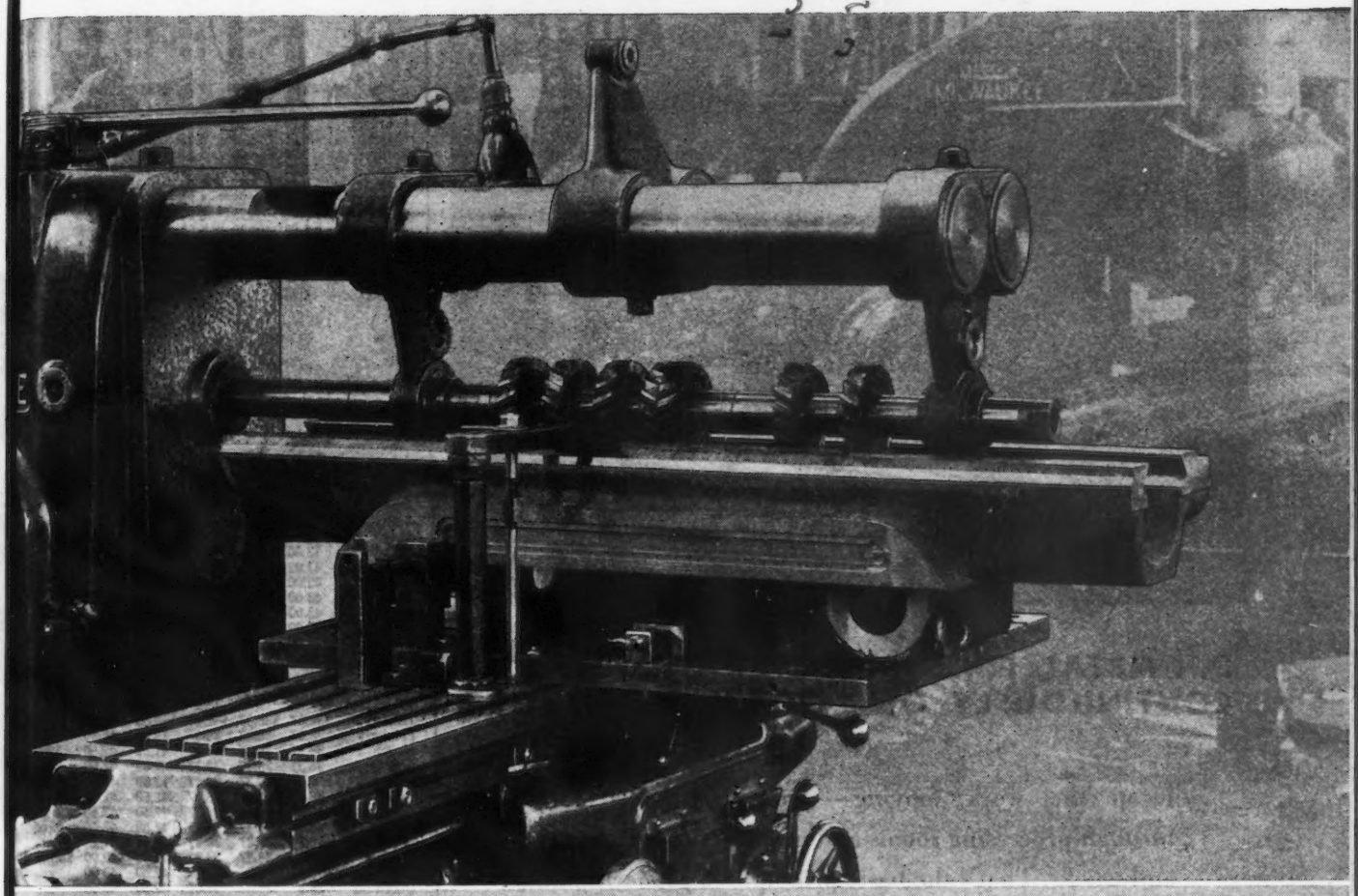
	1928	1929	1930	1931	1932	1933
January	3.65	3.60	3.33	2.90	2.80	2.88
February	3.65	3.60	3.30	2.90	2.75	2.50
March	3.65	3.60	3.30	2.90	2.85	2.60
April	3.65	3.60	3.30	2.84	2.85	2.63
May	3.58	3.60	3.23	2.80	2.85	2.70
June	3.50	3.60	3.19	2.74	2.85	2.70
July	3.48	3.60	3.13	2.90	2.85	2.85
August	3.40	3.50	3.05	2.90	2.81	2.85
September	3.40	3.50	3.00	2.90	2.75	2.85
October	3.50	3.50	2.99	2.90	2.85	2.85
November	3.50	3.48	2.95	2.90	2.85	2.85
December	3.58	3.40	2.92	2.86	2.85	2.85
Average	3.54	3.55	3.14	2.87	2.83	2.74

	1934	1935	1936	1937	1938	1944
January	2.85	3.10	3.10	3.40	3.80	1943
February	2.85	3.10	3.10	3.40	3.80	1942
March	2.85	3.10	3.10	3.72	3.80	1941
April	2.95	3.10	3.10	3.80	3.80	1940
May	3.25	3.10	3.10	3.80	3.80	1939
June	3.25	3.10	3.10	3.80	3.68	price
July	3.13	3.10	3.20	3.80	3.50	fixed
August	3.10	3.10	3.20	3.80	3.50	at
September	3.10	3.10	3.20	3.80	3.50	3.50
October	3.10	3.10	3.20	3.80	3.45	
November	3.10	3.10	3.20	3.80	3.50	
December	3.10	3.10	3.40	3.80	3.50	
Average	3.05	3.10	3.17	3.73	3.64	

TO MILL IT . . . WITH SPEED . . . PRECISION . . . PROFIT



"PUT IT ON A *Milwaukee*"

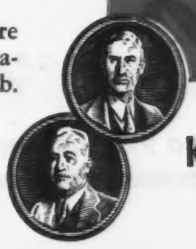


Five side-milling cutters and one pair of interlocking side-milling cutters are mounted on a special 51-½842 Milwaukee Arbor held in the spindle of a Milwaukee 4H Milling Machine. Two arbor braces support the arbor while a third increases overarm rigidity. Seven faces are straddle milled simultaneously in this set-up in which the knee is fed vertically.

Taking the tough jobs in stride — setting the pace in production milling — standing up with precision performance through the years — these qualities have made "Milwaukee" a top ranking name in milling machines.

Their ability to crack many a milling problem is reflected in the popular expression of machine tool men—"put it on a Milwaukee." Time-tested, production-proved, modern in every detail of design and construction but free of frills and novelties Milwaukee Milling Machines yield the sustained performance — with precision and speed — that spell profit in milling operations.

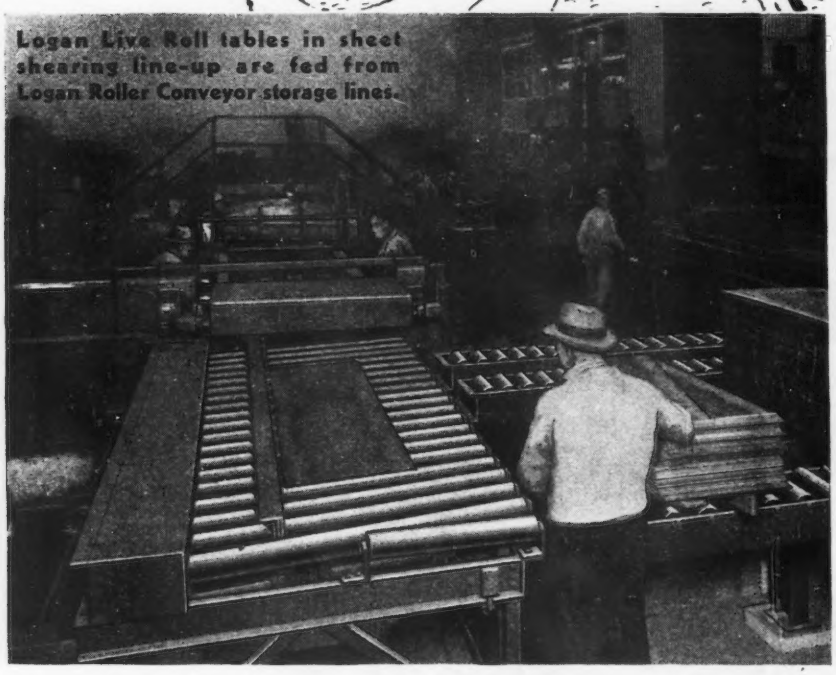
Select your milling equipment from the Milwaukee line of more than 70 models — the PoweRated Milling Machines — every machine engineered and built with ample power for every class of job.



Milwaukee Machine Tools

KEARNEY & TRECKER
CORPORATION
MILWAUKEE 14, WISCONSIN

Like super-highway traffic



Logan Live Roll tables in sheet shearing line-up are fed from Logan Roller Conveyor storage lines.

. . . METAL FINISHING OPERATIONS FLOW CONTINUOUSLY ON LOGAN CONVEYORS

Keep the work moving — *from* materials stores *through* processing rooms and machines *to* freight cars and trucks. That's the basic principle of modern plant operation, particularly in metal fabricating and finishing . . . and that's the *major premise* of all Logan Conveyor engineering! Logan *synchronizes* all types of conveyors into most effective, efficient and practical systems and makes the best use of power or gravity to keep production moving. With all types of conveyors in regular production and highly standardized, Logan can supply your requirements very economically. Send for informative Catalog 35-A. LOGAN CO., Inc., 545 Cabel St., Louisville 6, Ky.

Logan Conveyors

PUT *FLOW* INTO PRODUCTION

STATISTICAL

Tin Plate at Pittsburgh, Dollars a Base Box

	1928	1929	1930	1931	1932	1933
January	$5.25	$5.35	$5.25	$5.00	$4.75	$4.25
February	5.25	5.35	5.25	5.00	4.75	4.25
March	5.25	5.35	5.25	5.00	4.75	4.25
April	5.25	5.35	5.25	5.00	4.75	4.25
May	5.25	5.35	5.25	5.00	4.75	4.25
June	5.25	5.35	5.25	5.00	4.75	4.25
July	5.25	5.35	5.25	5.00	4.75	4.25
August	5.25	5.35	5.25	5.00	4.75	4.25
September	5.25	5.35	5.25	5.00	4.75	4.65
October	5.25	5.35	5.00	4.75	4.75	4.65
November	5.25	5.35	5.00	4.75	4.65	4.65
December	5.25	5.35	5.00	4.75	4.25	5.25
Average	5.25	5.35	5.19	4.94	4.69	4.43

	1934	1935	1936	1937	1938	
January	$5.25	$5.25	$5.25	$4.85	$5.35	1944
February	5.25	5.25	5.25	4.85	5.35	1943
March	5.25	5.25	5.25	4.85	5.35	1942
April	5.25	5.25	5.25	5.35	5.35	1941
May	5.25	5.25	5.25	5.35	5.35	1940
June	5.25	5.25	5.25	5.35	5.35	1939
July	5.25	5.25	5.25	5.35	5.35	price
August	5.25	5.25	5.25	5.35	5.35	fixed
September	5.25	5.25	5.25	5.35	5.35	at
October	5.25	5.25	5.25	5.35	5.35	$5.00
November	5.25	5.25	5.25	5.35	5.18	
December	5.25	5.25	5.25	5.35	5.00	
Average	5.25	5.25	5.25	5.22	5.31	

Steel Rails at Mill, Open-Hearth, Gross Ton

	1928	1929	1930	1931	1932	1933
January	$43.00	$43.00	$43.00	$43.00	$43.00	$40.00
February	43.00	43.00	43.00	43.00	43.00	40.00
March	43.00	43.00	43.00	43.00	43.00	40.00
April	43.00	43.00	43.00	43.00	43.00	40.00
May	43.00	43.00	43.00	43.00	43.00	40.00
June	43.00	43.00	43.00	43.00	43.00	40.00
July	43.00	43.00	43.00	43.00	43.00	40.00
August	43.00	43.00	43.00	43.00	43.00	40.00
September	43.00	43.00	43.00	43.00	43.00	40.00
October	43.00	43.00	43.00	43.00	42.25	39.55
November	43.00	43.00	43.00	43.00	40.00	38.38
December	43.00	43.00	43.00	43.00	40.00	38.38
Average	43.00	43.00	43.00	43.00	42.44	39.28

	1934	1935	1936	1937	1938	
January	$38.37	$38.37	$36.37	$39.00	$42.50	1944
February	38.37	38.37	36.37	39.00	42.50	1943
March	38.37	38.37	36.37	41.88	42.50	1942
April	38.37	38.37	36.37	42.50	42.50	1941
May	38.37	38.37	36.37	42.50	42.50	1940
June	38.37	38.37	36.37	42.50	42.50	1939
July	38.37	38.37	36.37	42.50	42.50	price
August	38.37	38.37	36.37	42.50	42.50	fixed
September	38.37	38.37	36.37	42.50	41.25	at
October	38.37	38.37	36.37	42.50	40.00	$40.00
November	38.37	38.37	36.37	42.50	40.00	
December	38.37	38.37	39.00	42.50	40.00	
Average	38.37	38.37	36.59	41.88	41.77	

Cold-Finished Steel Bars at Pittsburgh, Cents a Pound

	1929	1930	1931	1932	1933	1934
January	2.20	2.15	2.08	2.00	1.70	2.10
February	2.20	2.10	2.10	2.00	1.70	2.10
March	2.20	2.10	2.10	2.00	1.70	2.10
April	2.30	2.10	2.10	2.00	1.70	2.10
May	2.30	2.10	2.10	1.82	1.70	2.10
June	2.30	2.10	2.10	1.70	1.70	2.10
July	2.30	2.10	2.10	1.70	1.70	2.10
August	2.30	2.10	2.10	1.70	1.70	2.10
September	2.30	2.10	2.10	1.70	1.95	2.10
October	2.30	2.10	2.10	1.70	1.95	2.10
November	2.30	2.00	2.10	1.70	1.95	2.10
December	2.30	2.00	2.02	1.70	2.10	2.10
Average	2.28	2.09	2.09	1.81	1.80	2.10

	1935	1936	1937	1938	1939	
January	2.10	2.10	2.55	2.90	2.70	1944
February	2.10	2.10	2.55	2.90	2.70	1943
March	2.10	2.10	2.83	2.90	2.70	1942
April	2.01	2.10	2.90	2.90	2.70	1941
May	1.95	2.10	2.90	2.90	2.68	1940
June	1.95	2.10	2.90	2.70	2.65	price
July	1.95	2.25	2.90	2.70	2.65	fixed
August	1.95	2.25	2.90	2.70	2.65	at
September	1.95	2.25	2.90	2.70	2.65	2.65
October	1.95	2.35	2.90	2.70	2.65	
November	1.95	2.35	2.90	2.70	2.65	
December	1.95	2.35	2.90	2.70	2.65	
Average	1.99	2.20	2.84	2.78	2.67	

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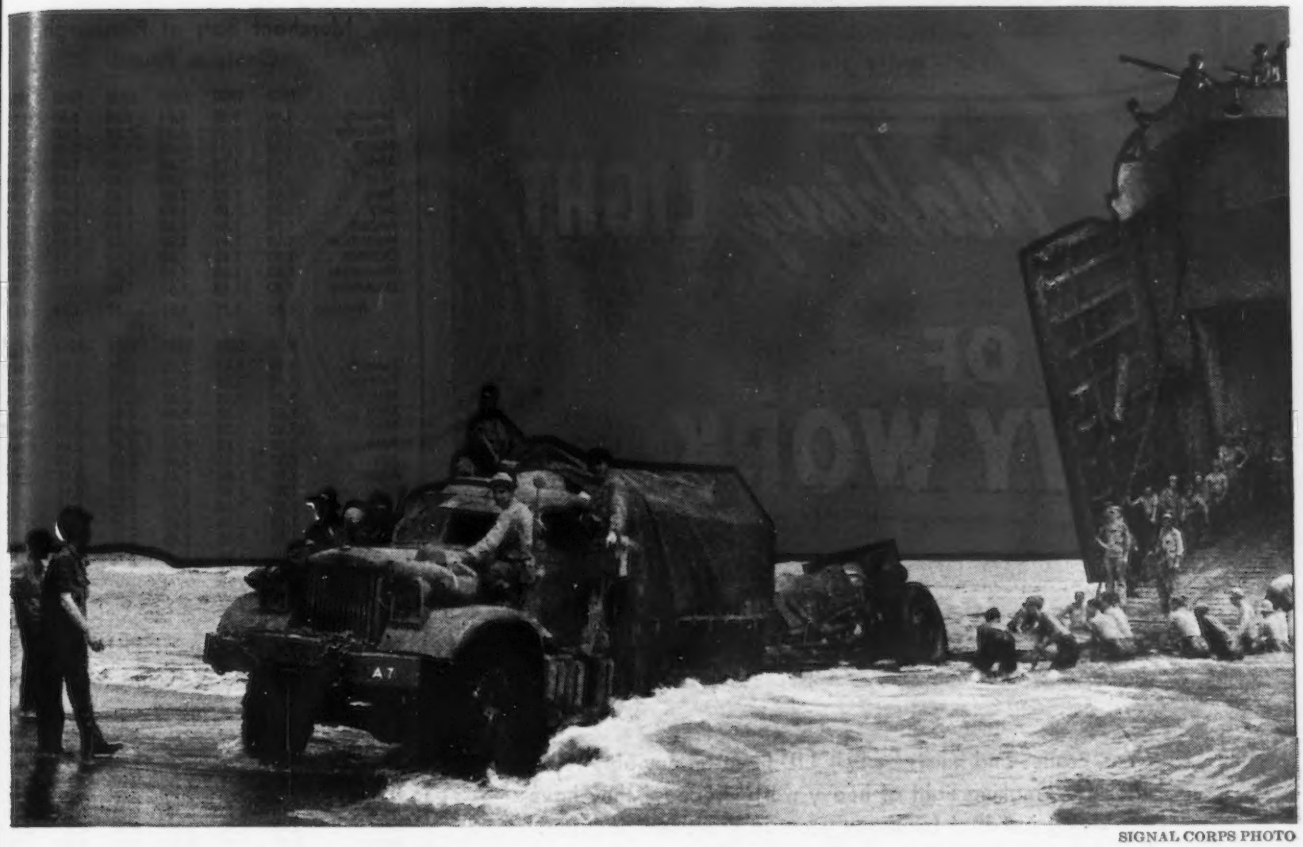

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STATISTICAL

Merchant Bars at Pittsburgh, Cents a Pound

	1929	1930	1931	1932	1933	1934
January	1.90	1.89	1.64	1.50	1.60	1.75
February	1.90	1.85	1.65	1.50	1.60	1.75
March	1.90	1.85	1.85	1.52	1.60	1.75
April	1.95	1.79	1.85	1.60	1.60	1.79
May	1.95	1.75	1.65	1.60	1.60	1.90
June	1.95	1.73	1.65	1.60	1.60	1.90
July	1.95	1.65	1.63	1.60	1.60	1.82
August	1.95	1.64	1.60	1.60	1 60	1.80
September	1.94	1.61	1.60	1.60	1.60	1.80
October	1.90	1.60	1.60	1.60	1.75	1.80
November	1.90	1.60	1.60	1.60	1.75	1.80
December	1.90	1.60	1.58	1.60	1.75	1.80
Average	1.92	1.71	1.63	1.57	1.64	1.81

	1935	1936	1937	1938	1939	1944
January	1.80	1.85	2.20	2.45	2.25	1943
February	1.80	1.85	2.20	2.45	2.25	1942
March	1.80	1.85	2.40	2.45	2.25	1941
April	1.80	1.85	2.45	2.45	2.25	1940
May	1.80	1.85	2.45	2.45	2.19	price
June	1.80	1.85	2.45	2.41	2.15	fixed
July	1.80	1.95	2.45	2.25	2.15	at
August	1.80	1.95	2.45	2.25	2.15	2.15
September	1.80	1.97	2.45	2.25	2.15	
October	1.85	2.05	2.45	2.25	2.15	
November	1.85	2.05	2.45	2.25	2.15	
December	1.85	2.05	2.45	2.25	2.15	
Average	1.81	1.93	2.40	2.35	2.19	

Plain Wire, Base at Pittsburgh, Cents a Pound

	1928	1929	1930	1931	1932	1933
January	2.40	2.50	2.40	2.20	2.20	2.16
February	2.48	2.50	2.40	2.20	2.20	2.10
March	2.50	2.50	2.40	2.20	2.20	2.10
April	2.50	2.50	2.38	2.20	2.20	2.10
May	2.50	2.50	2.30	2.20	2.20	2.10
June	2.50	2.50	2.30	2.20	2.20	2.10
July	2.42	2.50	2.30	2.20	2.20	2.10
August	2.40	2.43	2.30	2.20	2.20	2.10
September	2.40	2.40	2.30	2.20	2.20	2.10
October	2.40	2.40	2.30	2.20	2.20	2.10
November	2.40	2.40	2.30	2.20	2.20	2.10
December	2.48	2.40	2.22	2.20	2.20	2.20
Average	2.45	2.46	2.33	2.20	2.20	2.11

	1934	1935	1936	1937	1938	1944
January	2.20	2.30	2.30	2.60	2.90	1943
February	2.20	2.30	2.30	2.60	2.90	1942
March	2.20	2.30	2.30	2.84	2.90	1941
April	2.23	2.30	2.40	2.90	2.90	1940
May	2.30	2.30	2.40	2.90	2.90	1939
June	2.30	2.30	2.40	2.90	2.84	price
July	2.30	2.30	2.40	2.90	2.60	fixed
August	2.30	2.30	2.40	2.90	2.60	at
September	2.30	2.30	2.40	2.90	2.60	2.60
October	2.30	2.30	2.50	2.90	2.60	
November	2.30	2.30	2.50	2.90	2.60	
December	2.30	2.30	2.60	2.90	2.60	
Average	2.27	2.30	2.41	2.84	2.74	

Structural Shapes at Pittsburgh, Cents a Pound

	1928	1929	1930	1931	1932	1933
January	1.81	1.90	1.83	1.64	1.50	1.60
February	1.85	1.90	1.80	1.65	1.50	1.60
March	1.85	1.90	1.80	1.65	1.52	1.60
April	1.85	1.95	1.80	1.65	1.60	1.60
May	1.85	1.95	1.73	1.65	1.60	1.60
June	1.85	1.95	1.69	1.65	1.60	1.60
July	1.85	1.95	1.65	1.63	1.60	1.60
August	1.90	1.95	1.61	1.60	1.60	1.60
September	1.90	1.95	1.60	1.60	1.60	1.60
October	1.90	1.90	1.60	1.60	1.60	1.70
November	1.90	1.90	1.60	1.60	1.60	1.70
December	1.90	1.90	1.60	1.50	1.60	1.70
Average	1.87	1.92	1.69	1.62	1.57	1.68

	1934	1935	1936	1937	1938	1944
January	1.70	1.80	1.80	2.05	2.25	1943
February	1.70	1.80	1.80	2.05	2.25	1942
March	1.70	1.80	1.80	2.21	2.25	1941
April	1.74	1.80	1.80	2.25	2.25	1940
May	1.85	1.80	1.80	2.25	2.25	1939
June	1.85	1.80	1.80	2.25	2.22	price
July	1.81	1.80	1.90	2.25	2.10	fixed
August	1.80	1.80	1.90	2.25	2.10	at
September	1.80	1.89	1.90	2.25	2.10	2.10
October	1.80	1.80	1.90	2.25	2.10	
November	1.80	1.80	1.90	2.25	2.10	
December	1.80	1.80	1.90	2.25	2.10	
Average	1.78	1.80	1.85	2.21	2.17	

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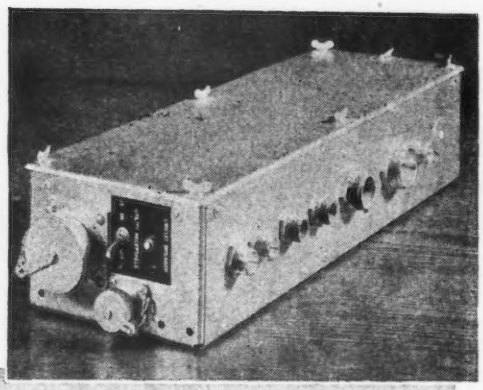

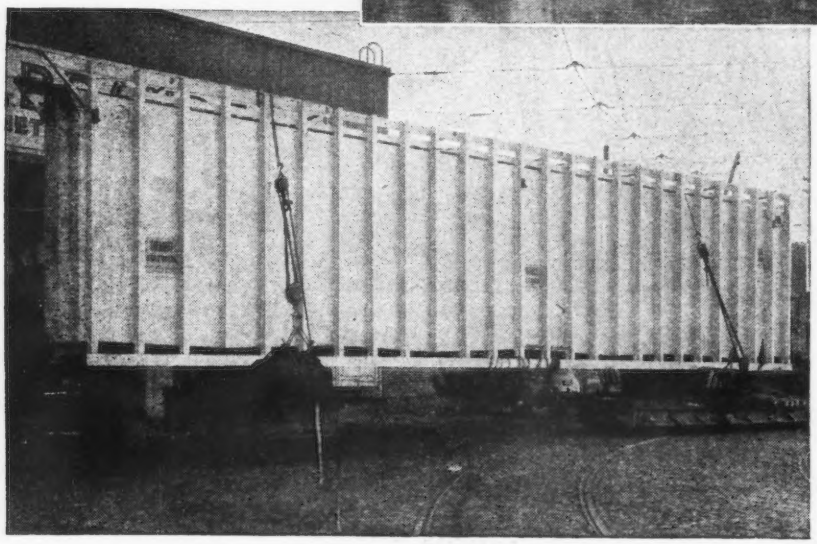

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STATISTICAL

Scrap Steel Composite Price

Average of THE IRON AGE *quotations o No. 1 heavy melting scrap at Pittsburgh Chicago and Philadelphia—Gross ton.*

	1932	1933	1934	1935	1936	193
January	$8.41	$6.77	$11.73	$12.29	$13.47	$18.
February	8.27	6.83	12.25	11.98	14.12	19.
March	8.23	6.96	12.82	11.06	14.75	21.
April	8.12	7.73	12.54	10.46	14.59	21.
May	7.48	9.70	11.57	10.70	13.39	18.
June	6.89	9.97	10.67	10.74	12.81	17.
July	6.46	11.27	10.53	10.96	13.29	18.
August	6.93	12.08	10.15	12.25	15.04	20.
September	7.69	11.35	9.63	12.71	16.45	18.
October	7.62	10.56	9.54	12.67	16.63	15.
November	7.45	9.94	10.04	12.90	16.31	13.
December	6.92	10.50	11.43	13.33	17.10	13.
Average	7.54	9.47	11.07	11.85	14.83	18.

	1938	1939	1940	1941	1943	194
January	$14.00	$14.94	$17.58	$20.88	1942	$19.
February	13.86	15.01	16.88	20.08	price	19.
March	13.48	15.20	16.56	20.29	fixed	19.
April	12.40	14.77	16.14	19.22	at	19.
May	11.54	14.17	17.60	19.17	$19.17	19.
June	11.32	14.71	19.31	19.17		19.
July	13.29	14.92	18.47	19.17		19.
August	14.51	15.43	18.72	19.17		19.
September	14.34	18.32	19.91	19.17		17.
October	14.21	21.48	20.63	19.17		15.
November	14.74	19.66	20.83	19.17		16.
December	14.88	18.05	21.42	19.17		19.
Average	13.54	16.39	18.67	19.49		18.

No. 1 Heavy Melting Steel Scrap at Pittsburgh, Gross Ton

	1932	1933	1934	1935	1936	1937
January	$10.22	$ 8.30	$13.00	$13.35	$14.44	$19.50
February	10.25	8.50	14.00	13.06	14.98	19.81
March	10.25	8.88	14.44	12.19	15.75	23.19
April	10.12	10.00	14.19	11.55	15.75	22.25
May	9.60	11.75	12.80	11.62	14.50	19.38
June	8.75	11.75	11.75	11.75	13.57	18.45
July	8.25	12.72	11.75	11.95	14.19	19.75
August	8.60	13.85	11.31	12.94	15.94	21.85
September	9.54	12.94	10.75	13.25	17.80	19.62
October	9.62	12.15	10.35	13.40	17.87	16.62
November	9.15	11.50	10.94	13.56	17.31	13.75
December	8.75	12.13	13.01	14.05	18.31	13.75
Average	9.42	11.21	12.36	12.72	15.87	18.86

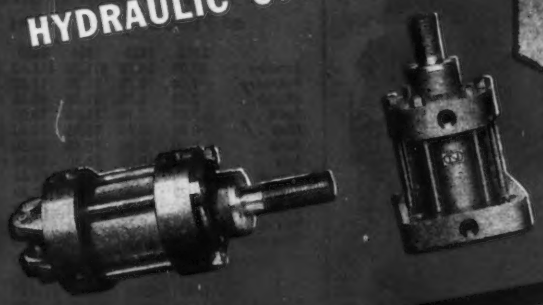
	1938	1939	1940	1941	1943	1944
January	$14.25	$15.72	$18.35	$22.13	1942	$20.00
February	14.13	15.72	17.50	21.00	price	20.00
March	13.67	15.97	16.88	21.00	fixed	20.00
April	12.44	15.31	16.55	20.20	at	20.00
May	11.50	14.48	18.37	20.00	$20.00	20.00
June	11.30	15.12	20.06	20.00		20.00
July	14.25	15.56	19.10	20.00		20.00
August	15.45	16.15	18.56	20.00		19.98
September	15.25	19.88	20.00	20.00		18.25
October	15.00	23.05	21.45	20.00		16.10
November	15.28	20.56	21.69	20.00		17.13
December	15.75	18.58	22.28	20.00		19.94
Average	14.02	17.17	19.23	20.36		19.28

No. 1 Heavy Melting Steel Scrap at Chicago, Gross Ton

	1932	1933	1934	1935	1936	1937
January	$7.50	$5.25	$10.50	$11.80	$13.37	$17.81
February	7.25	5.25	11.00	11.25	14.19	19.25
March	7.25	5.25	12.13	10.50	14.75	20.60
April	7.14	6.00	11.75	9.85	14.34	20.56
May	6.45	8.45	11.05	10.06	12.87	17.12
June	5.69	8.91	9.75	9.97	12.85	15.70
July	4.88	10.42	9.55	10.35	13.37	17.62
August	5.75	10.46	9.19	12.38	15.19	19.70
September	6.25	9.84	8.50	12.50	16.15	17.56
October	6.00	9.47	8.75	12.50	16.25	14.69
November	5.93	8.60	9.25	13.00	16.50	12.50
December	5.25	8.94	10.50	13.25	17.00	12.38
Average	6.28	8.07	10.16	11.45	14.74	17.12

	1938	1939	1940	1941	1943	1944
January	$13.00	$13.87	$16.38	$20.00	1942	$18.75
February	12.69	13.94	15.75	19.25	price	18.75
March	12.15	14.25	15.69	19.38	fixed	18.75
April	11.37	13.37	15.33	18.95	at	18.75
May	11.00	12.75	17.00	18.75	$18.75	18.75
June	10.45	13.45	18.19	18.75		18.75
July	12.00	13.50	17.35	18.75		18.75
August	13.75	13.87	18.03	18.75		18.75
September	13.50	16.22	19.22	18.75		18.69
October	12.88	19.16	19.75	18.75		16.90
November	14.20	17.85	20.06	18.75		17.00
December	13.75	16.67	20.60	18.75		18.69
Average	12.56	14.91	17.73	19.01		18.27

HYDRAULIC CYLINDERS



T-J

PERFORMANCE UPS PRODUCTION CUTS COSTS!

AIR CYLINDERS

DIE SINKING MILLING CUTTERS

● T-J Products have shown outstanding ability to "take it" . . . performing tough jobs for industry with unbeatable *accuracy, efficiency* and *dependability!*

That's why more and more practical production men *specify* T-J where there's a job for Rivitors . . . hydraulic cylinders . . . or air cylinders . . . cutters . . . Clinchors . . . or air controls. All T-J Products expertly engineered . . . precision-built . . . rigidly inspected . . . right in every respect! Send for latest bulletins. The Tomkins-Johnson Company, Jackson, Michigan.

AIR CONTROLS

CLINCHORS

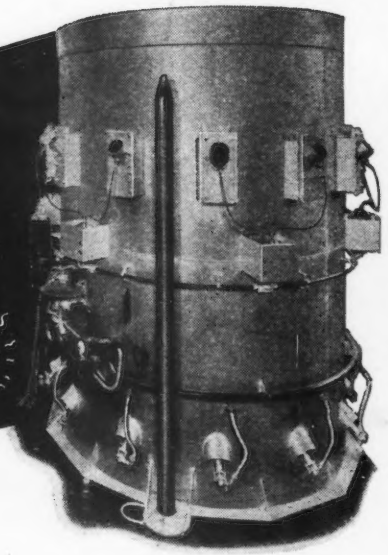
RIVITORS

T-J

TOMKINS-JOHNSON

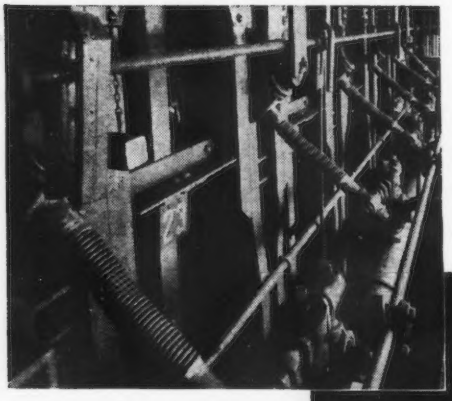
RIVITORS...AIR AND HYDRAULIC CYLINDERS...CUTTERS...CLINCHORS

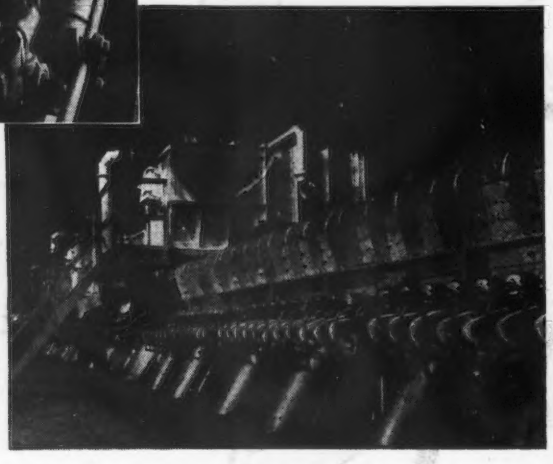
REX-WELD handles jobs that are too hot to handle



MODERN industry is full of jobs that are "too hot to handle"—applications at high temperature levels, which often burn out ordinary connections not built to take extreme heat. But REX-WELD works efficiently at temperatures up to 1,000° F. and burst pressures up to 11,000 p.s.i. Result: fewer delays . . . lower maintenance costs.

Alert engineers have been quick to recognize the superior characteristics of rugged, flexible REX-WELD for feeding gas to industrial burners . . . for connections on coke ovens . . . heavy-duty steel mill service . . . and many high and low pressure steam, oil, and hydraulic requirements. REX-WELD is available, braided or unbraided, in sizes from ⅛" to 4" I. D. (incl.), with soldered or re-attachable Rex-Tite heat-proof mechanical couplings in male or female, swivel or solid types. Write for complete information today.





(At Top) Rex-Weld Equalizer connections on annealing furnace. (Above) Rex-Weld conveying coke oven gas.

Rex-Weld type RW-80 on pipe welding furnace.

Flexible Metal Hose for Every Industrial Use

ARMY E NAVY

CMH

CHICAGO METAL HOSE CORPORATION

MAYWOOD, ILLINOIS

Plants: Maywood and Elgin, Ill.

STATISTICAL

No. 1 Heavy Melting Steel Scrap at Philadelphia, Gross Ton

	1932	1933	1934	1935	1936	1937
January	$7.00	$6.75	$11.70	$11.40	$12.62	$17.37
February	7.00	6.75	11.75	11.62	13.25	18.50
March	7.00	6.75	11.88	10.50	13.75	19.60
April	7.50	7.19	11.69	10.00	13.69	20.00
May	6.00	8.90	10.95	10.44	12.81	18.62
June	6.00	9.25	10.50	10.50	12.00	17.20
July	6.00	10.68	10.30	10.55	12.31	19.00
August	6.30	11.95	9.94	11.44	14.00	19.75
September	7.25	11.25	9.63	12.38	15.40	19.00
October	7.25	10.20	9.53	12.10	15.75	16.38
November	7.25	9.75	9.94	12.13	15.12	13.75
December	6.75	10.44	10.75	12.50	15.50	14.25
Average	6.77	9.16	10.71	11.30	13.85	17.78

	1938	1939	1940	1941	1943	1944
January	$14.75	$15.25	$18.00	$20.50	1942	$18.75
February	14.75	15.25	17.38	20.00	price	18.75
March	14.55	15.38	17.12	20.00	fixed	18.75
April	13.37	15.62	16.75	19.00	at	18.75
May	12.13	15.25	17.56	18.75	$18.75	18.75
June	12.20	15.41	19.69	18.75		18.75
July	13.63	15.62	18.95	18.75		18.75
August	14.35	16.25	19.56	18.75		18.60
September	14.25	18.87	20.50	18.75		16.66
October	14.75	22.35	20.70	18.75		14.69
November	14.75	20.75	20.75	18.75		15.50
December	15.12	18.92	20.85	18.75		18.50
Average	14.05	17.08	18.98	19.13		17.01

No. 1 Machinery Cast Scrap, at Chicago, Gross Ton*

	1929	1932	1933	1934	1935	1936
January	$15.81	$7.75	$6.25	$9.50	$10.60	$12.00
February	16.25	7.50	6.25	9.50	10.00	12.75
March	16.00	7.20	6.25	9.50	9.38	13.10
April	16.00	7.00	7.06	9.50	9.00	12.50
May	15.39	6.50	8.45	8.90	9.00	12.00
June	14.75	6.13	8.75	7.50	9.00	12.00
July	14.50	6.00	10.63	8.05	9.30	12.12
August	14.50	6.10	10.50	8.00	10.87	13.37
September	14.50	6.25	10.00	8.00	11.19	13.60
October	14.50	6.25	9.88	8.00	11.25	14.00
November	13.63	6.25	8.60	8.25	11.50	14.00
December	13.50	6.25	8.75	9.65	11.80	14.75
Average	15.11	6.60	8.45	8.69	10.24	13.02

	1937	1938	1939	1940	1941	1944†
January	$15.87	$12.50	$12.58	$14.00	$18.88	1943
February	16.25	12.19	12.75	13.75	19.25	1942
March	17.40	11.65	12.75	13.56	20.75	price
April	17.12	10.88	12.12	14.81	*22.33	fixed
May	15.25	10.75	11.75	16.31	21.40	at
June	15.00	10.45	12.15	17.31	20.00	$20.00
July	15.75	12.00	12.25	16.75	20.00	
August	16.55	13.35	12.25	16.88	20.00	
September	14.38	13.00	14.50	17.13	20.00	
October	13.18	12.25	16.87	17.75	20.00	
November	11.65	12.60	15.65	18.00	20.00	
December	12.12	12.50	14.50	19.13	20.00	
Average	15.04	12.01	13.34	16.28	20.21	

* Changed from net ton basis April 30, 1941.
† Ceiling price does not include delivery costs.

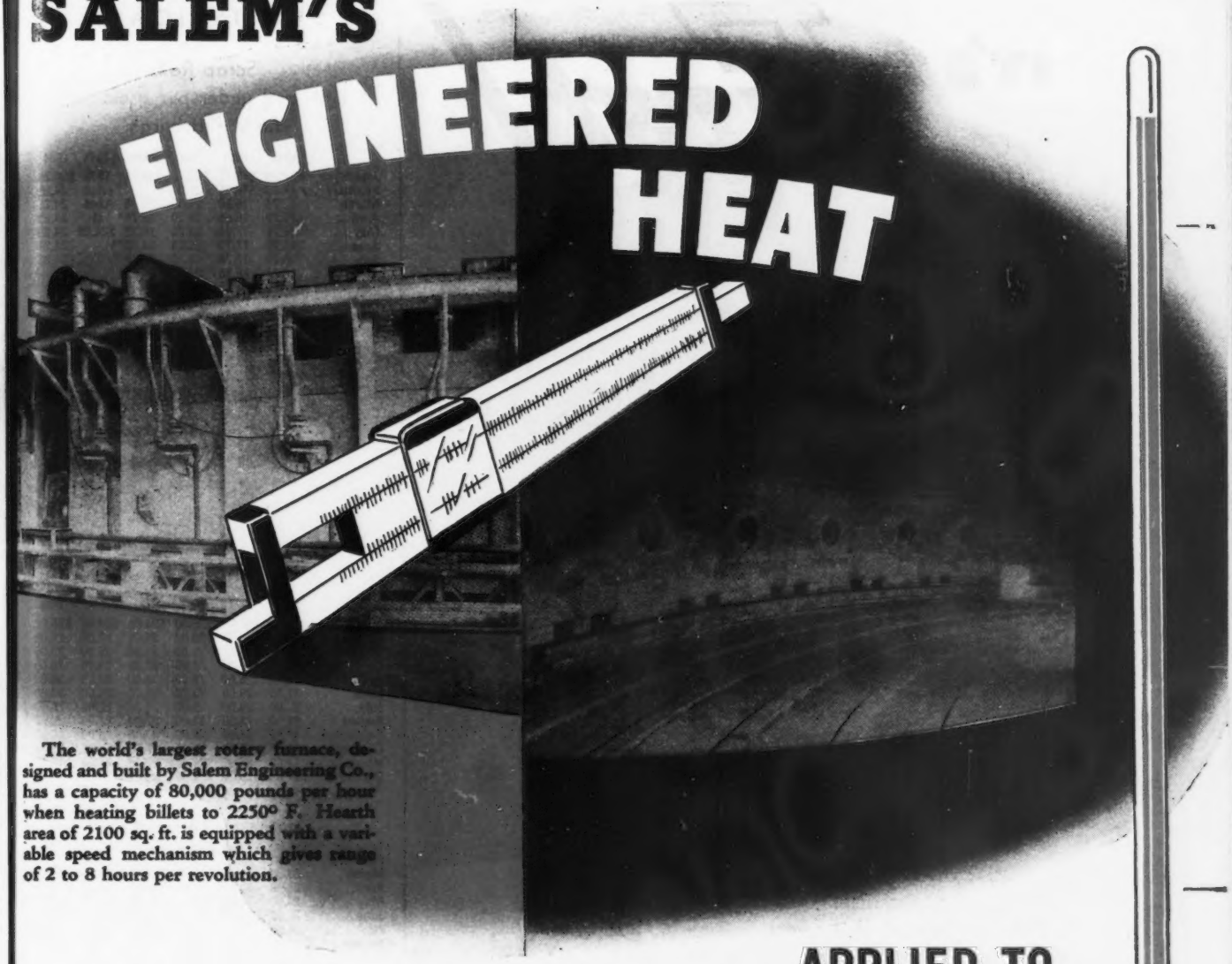
No. 1 Machinery Cast, at Cincinnati, Gross Ton

	1929	1932	1933	1934	1935	1936
January	$17.14	$10.00	$ 7.55	$ 9.50	$10.25	$11.37
February	17.24	10.00	8.50	9.50	9.94	11.75
March	17.19	10.00	8.50	10.00	9.19	12.40
April	17.19	10.00	8.50	10.00	8.75	12.19
May	17.19	10.00	8.75	9.45	8.87	11.50
June	17.19	8.50	7.13	9.00	9.06	11.20
July	17.19	8.00	8.75	9.00	9.10	11.19
August	17.05	7.50	9.50	8.88	9.94	12.43
September	16.96	8.00	9.50	8.75	10.00	13.60
October	16.92	8.25	9.50	8.75	10.50	14.00
November	16.57	8.25	9.12	8.88	10.50	14.00
December	16.52	8.25	9.19	9.85	10.90	15.12
Average	17.03	8.90	8.04	9.30	9.75	12.56

	1937	1938	1939	1940	1941	1944†
January	$15.75	$11.25	$13.75	$17.65	$22.75	1943
February	16.12	10.87	13.75	16.69	22.50	1942
March	17.30	11.05	14.38	16.25	*22.50	price
April	17.37	10.62	13.56	16.05	....	fixed
May	14.44	10.25	12.00	16.88	....	at
June	14.00	10.10	12.13	19.38	....	$20.00
July	14.87	11.75	12.25	18.65	....	
August	16.25	12.65	12.80	18.75	....	
September	14.25	12.31	15.38	20.12	*22.50	
October	13.38	12.31	19.55	20.55	22.50	
November	11.85	13.15	18.88	21.00	22.50	
December	10.75	13.88	17.75	22.50	22.50	
Average	14.69	11.68	14.68	18.71	....	

* In transition from open market quotations to OPA price maximums, this grade not quoted. However, in September, the maximum schedules were revised to include this grade.
† Ceiling price does not include delivery costs.

SALEM'S ENGINEERED HEAT



The world's largest rotary furnace, designed and built by Salem Engineering Co., has a capacity of 80,000 pounds per hour when heating billets to 2250° F. Hearth area of 2100 sq. ft. is equipped with a variable speed mechanism which gives range of 2 to 8 hours per revolution.

. . . . . APPLIED TO THE WORLD'S LARGEST ROTARY FORGE FURNACE

SALEM'S Engineered Heat combines engineering with economics to produce an efficient and profitable heat treating installation for the customer.

For instance, consider the case of the world's largest rotary forge furnace, 2100 sq. ft. of hearth area, designed and built by Salem Engineering Company.

Our engineers had no precedent as a guide. They simply knew that costs on the customer's sloping hearth furnace for heating round billets up to 10" in diameter and lengths up to 12', had been much too high.

The Salem rotary, in more than two years of operation, has saved the customer an average of 2% in scale loss alone. It has relieved six men per turn for other work, and the maintenance cost has been low.

The operating men and Salem's engineers attribute the performance to sound design plus unique mechanical features.

Learn how Salem's Engineered Heat plan can cut your heat treating costs.

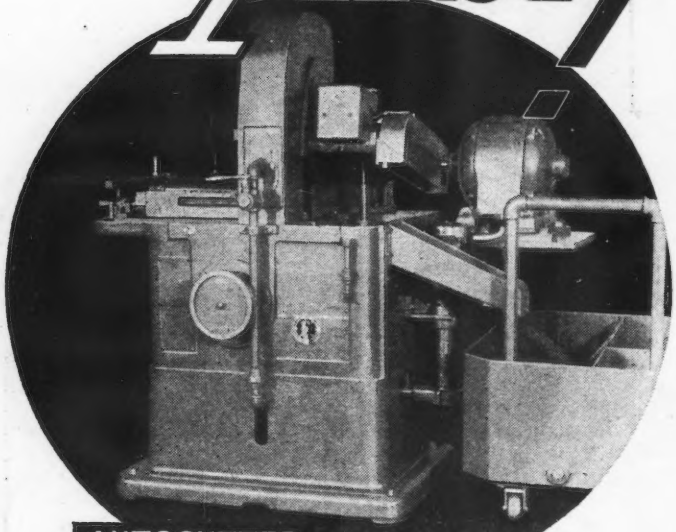
Send your inquiry to Salem Engineering Company at Salem, Ohio.

SALEM **SALEM** OHIO

ENGINEERING CO.

SALEM ENGINEERING COMPANY

IT'S A First



AUTOCUTTER

Yes, this **CAMPBELL "MODEL 700"** is the first *fully automatic* abrasive cutting machine ever built. Coming from **CAMPBELL**, manufacturers of the most complete range of abrasive cutters, that's big news.

This "700" is "first" another way. It is the opening announcement of **CAMPBELL'S** post-war program of development, based on wartime improvements all through the line. Other announcements will follow.

Maybe there's a way a **CAMPBELL ABRASIVE CUTTER** could speed up or economize your production. It's easy to find out.

WHY NOT DO THIS?

Write and tell us (1) the range of sizes, (2) kind of material, (3) length of cutoff pieces, (4) length of stock before cutting, (5) tolerance for length of cut pieces and (6) hourly production requirement. With this information, **CAMPBELL** engineers can recommend production procedure and work up cost sheets for you.

Campbell

ABRASIVE CUTTING MACHINES

ANDREW C. CAMPBELL DIVISION

BRIDGEPORT • CONNECTICUT

ALSO MAKERS OF A COMPLETE LINE OF NIBBLING MACHINES

ACCO

AMERICAN CHAIN & CABLE COMPANY, Inc.

BRIDGEPORT • CONNECTICUT

STATISTICAL

Scrap Rails
2 ft. and under per gross ton f.o.b. Pittsburgh

	1938	1939	1940	1941	1943	1944
January	$18.25	$17.75	$22.75	$26.75	1942	$24.25
February	18.75	18.25	21.00	....	price	24.25
March	17.75	18.50	21.00	26.75	fixed	24.25
April	17.75	18.25	21.50	19.75*	at	24.25
May	16.75	17.25	22.75	19.75	$24.25	24.25
June	15.75	17.75	25.25	24.25**		24.25
July	16.25	17.75	22.75	24.25		24.25†
August	16.75	19.25	22.75	24.25		
September	17.25	26.25	25.75	24.25		
October	17.25	26.75	26.75	24.25		
November	17.25	22.75	27.25	24.25		
December	17.25	22.75	27.25	24.25		
Average	17.21	20.93	23.89	23.88		

* OPA ceiling price.
** Readjusted OPA ceiling price at Pittsburgh."
† Rails 2 ft. in length eliminated from MPR No. 4 by OPA action in July.

•

Spiegeleisen (19 to 21 Per Cent), Gross Ton, at Furnace

	1929	1931	1932	1933	1934	1935
January	$31.00	$28.00	$26.00	$24.00	$27.00	$26.00
February	31.00	28.00	26.00	24.00	27.00	26.00
March	31.00	28.00	26.00	24.00	26.50	26.00
April	31.00	28.00	26.00	24.00	26.00	26.00
May	31.00	28.00	26.00	24.00	24.00	26.00
June	31.00	28.00	25.75	24.00	26.00	26.00
July	31.00	28.00	25.00	27.00	26.00	26.00
August	31.00	28.00	25.00	27.00	26.00	26.00
September	31.00	28.00	25.00	27.00	26.00	26.00
October	31.00	28.00	25.00	27.00	26.00	26.00
November	31.00	28.00	24.40	27.00	26.00	26.00
December	31.00	26.20	24.00	27.00	26.00	26.00
Average	31.00	27.85	25.35	25.50	26.21	26.00

	1936	1937	1938	1939	1940	
January	$26.00	$26.00	$33.00	$28.00	$32.00	1944
February	26.00	26.00	33.00	28.00	32.00	1943
March	26.00	28.40	33.00	28.00	32.00	1942
April	26.00	30.00	33.00	28.00	32.00	1941
May	26.00	32.25	33.00	28.00	32.00	price
June	26.00	33.00	33.00	28.00	34.40	fixed
July	26.00	33.00	28.00	28.00	36.00	at
August	26.00	33.00	28.00	28.00	36.00	$36.00
September	26.00	33.00	28.00	31.00	36.00	
October	26.00	33.00	28.00	32.00	36.00	
November	26.00	33.00	28.00	32.00	36.00	
December	26.00	33.00	28.00	32.00	36.00	
Average	26.00	31.14	30.50	29.25	34.20	

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50 Per Cent Ferrosilicon, Carloads, Gross Ton, Delivered East of Mississippi River

	1932	1933	1934	1935	1936	1937
January	$77.50	$74.50	$77.50	$77.50	$77.50	$69.50
February	77.50	74.50	77.50	77.50	77.50	69.50
March	77.50	74.50	77.50	77.50	77.50	69.50
April	77.50	74.50	77.50	77.50	77.50	69.50
May	77.50	74.50	77.50	77.50	77.50	69.50
June	77.50	74.50	77.50	77.50	77.50	69.50
July	77.50	74.50	77.50	77.50	69.50	69.50
August	77.50	74.50	77.50	77.50	69.50	69.50
September	77.50	74.50	77.50	77.50	69.50	69.50
October	77.50	74.50	77.50	77.50	69.50	69.50
November	77.50	74.50	77.50	77.50	69.50	69.50
December	77.50	74.50	77.50	77.50	69.50	69.50
Average	77.50	74.50	77.50	77.50	73.50	69.50

	1938	1939	1940	1942	1943	1944
January	$69.50	$69.50	$69.50	1941	$74.50	$74.48
February	69.50	69.50	69.50	price	74.50	74.48
March	69.50	69.50	69.50	fixed	74.50	74.48
April	69.50	69.50	69.50	at	74.50	74.48
May	69.50	69.50	69.50	$74.50	74.50	74.48
June	69.50	69.50	72.00		74.49	74.48
July	69.50	69.50	74.50		74.48	74.48
August	69.50	69.50	74.50		74.48	74.48
September	69.50	69.50	74.50		74.48	74.48
October	69.50	69.50	74.50		74.48	74.48
November	69.50	69.50	74.50		74.48	74.48
December	69.50	69.50	74.50		74.48	74.48
Average	69.50	69.50	72.11		74.49	74.48

FOR WIDER RANGE *Operations...*

MOORE RAPID *Lectromelt* FURNACES

The wide range of operations possible with Lectromelt furnaces is an important consideration in the melting of quality steels and irons. With the Lectromelt, all the products that can be made in cupola, open hearth, Bessemer or crucible types of melting furnaces can be made under better control and of superior quality.

This flexibility is but one of the advantages of the Lectromelt furnaces which can be operated on either cold scrap or hot metal charges. Greater production per-man-hour, maximum refractory life and lowered electrode costs as well as the ability to pour large and small heats are other features of Lectromelt's top-charge swing-aside-roof furnaces.

Lectromelt top-charge furnaces are built from 100 tons down to 250 pounds. Write for complete details.

Above is illustrated a size "MT" Lectromelt in operation. This furnace nominally pours heats of 25 tons.

PITTSBURGH LECTROMELT FURNACE CORPORATION

PITTSBURGH 30, PENNA.

The Strong Way

Pays in many ways

YOU CAN PUT IT ALL UP TO STRONG, *if you have a steel casting from 30 pounds to 30,000 pounds—or a size range of almost any conceivable shape or proportion. The sweep method shown above—typical of Strong's versatility—saves the customer the costly pattern making otherwise needed for this unusually shaped, 33,000 pound casting. Strong molding facilities range from small snap flasks to steel flasks 16 feet square. This size range is governed only by the size of Strong's largest annealing oven (15 x 19 feet). Be sure you know the modern art of steel casting, as Strong has developed it!*

STRONG IN NAME
STRONG IN FACT

STRONG STEEL FOUNDRY COMPANY, BUFFALO, N.Y.

Strong

TENSILE STRENGTH · ELONGATION

STATISTICAL

Ferromanganese (80 Per Cent) Gross Ton, at Seaboard

	1932	1933	1934	1935	1936	1937
January	$75.00	$68.00	$85.00	$85.00	$75.00	$80.00
February	75.00	68.00	85.00	85.00	75.00	80.00
March	75.00	68.00	85.00	85.00	75.00	89.00
April	75.00	68.00	85.00	85.00	75.00	95.00
May	75.00	68.00	85.00	85.00	75.00	100.82
June	68.00	68.00	85.00	85.00	75.00	102.50
July	68.00	82.00	85.00	85.00	75.00	102.50
August	68.00	82.00	85.00	85.00	75.00	102.50
September	68.00	82.00	85.00	85.00	75.00	102.50
October	68.00	82.00	85.00	85.00	75.00	102.50
November	68.00	82.00	85.00	85.00	80.00	102.50
December	68.00	82.00	85.00	85.00	80.00	102.50
Average	70.92	75.00	85.00	85.00	75.83	96.84

	1938	1939	1940	1941	1942	1944
January	$102.50	$85.00	$100.00	$120.00	$120.00	1943
February	102.50	80.00	100.00	120.00	120.00	price
March	102.50	80.00	100.00	120.00	120.00	fixed
April	102.50	80.00	100.00	120.00	120.00	at
May	102.50	80.00	100.00	120.00	135.00	$135.00
June	102.50	80.00	110.00	120.00	135.00	
July	92.50	80.00	120.00	120.00	135.00	
August	92.50	80.00	120.00	120.00	135.00	
September	92.50	95.00	120.00	120.00	135.00	
October	92.50	100.00	120.00	120.00	135.00	
November	92.50	100.00	120.00	120.00	135.00	
December	92.50	100.00	120.00	120.00	135.00	
Average	97.50	86.67	110.84	120.00	130.00	

Electrolytic Copper, Conn. Valley, Cents a Pound

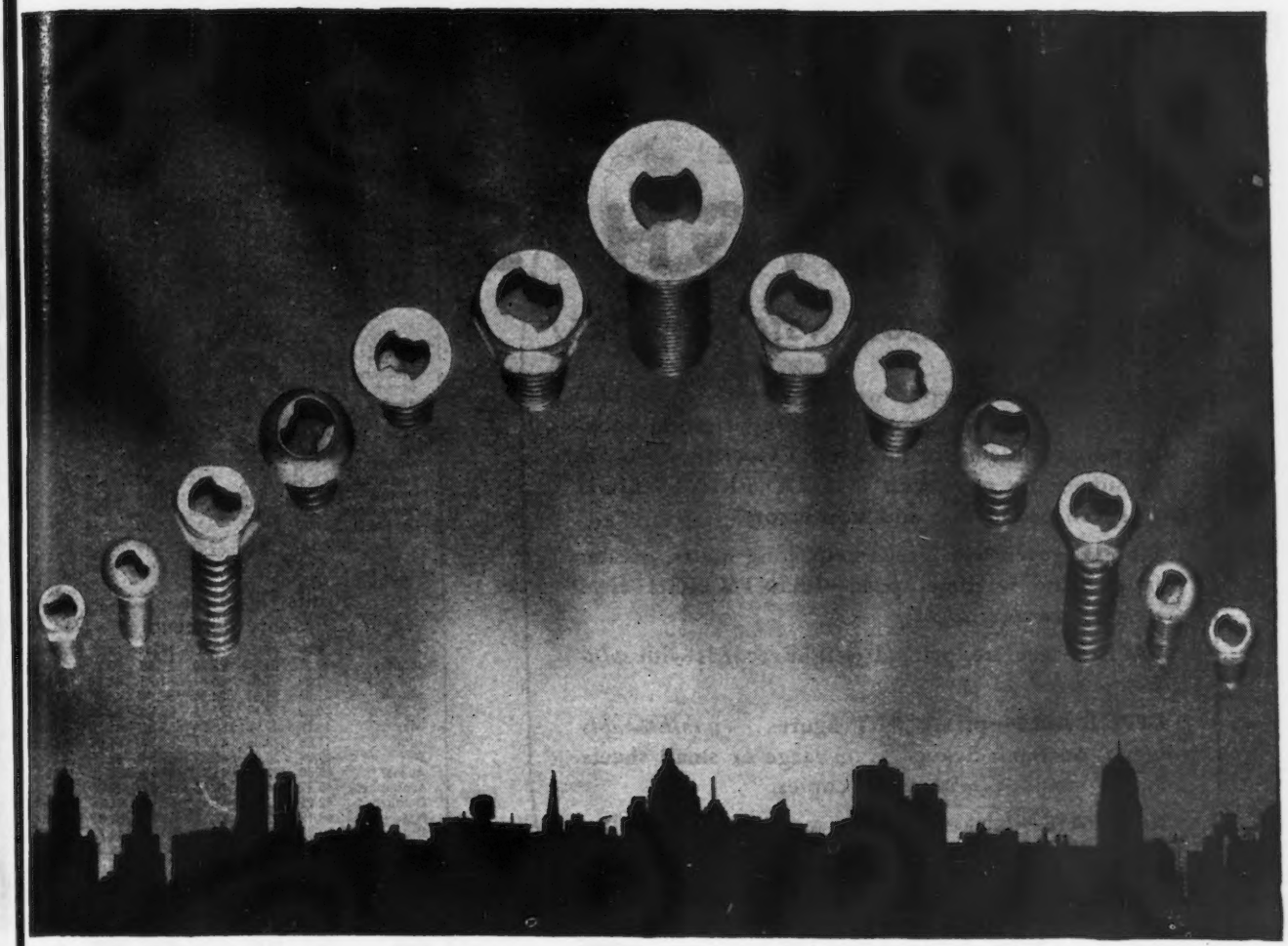
	1929	1931	1932	1933	1934	1935
January	16.84	10.03	7.33	5.00	8.18	9.00
February	18.05	9.96	6.25	5.00	8.00	9.00
March	21.38	10.14	5.99	5.26	8.00	9.00
April	19.93	9.69	5.79	5.68	8.39	9.00
May	18.00	8.94	5.51	6.93	8.50	9.00
June	18.00	8.31	5.39	8.00	8.82	8.88
July	18.00	7.93	5.28	8.91	9.00	8.00
August	18.00	7.52	5.43	9.00	9.00	8.22
September	18.03	7.26	6.21	9.00	9.00	8.77
October	18.00	7.01	5.97	8.25	9.00	9.19
November	18.00	6.80	5.31	8.16	9.00	9.25
December	18.00	6.85	5.04	8.12	9.00	9.25
Average	18.35	8.37	5.79	7.28	8.66	8.88

	1936	1937	1938	1939	1940	1944
January	9.25	12.66	10.42	11.25	12.22	1943
February	9.25	13.60	10.00	11.25	11.40	1942
March	9.25	15.99	10.00	11.25	11.38	1941
April	9.40	15.35	10.00	10.47	11.33	price
May	9.50	14.00	9.60	10.06	11.32	fixed
June	9.50	14.00	9.00	10.00	11.37	at
July	9.60	14.00	9.81	10.22	10.81	12.00
August	9.75	14.00	10.12	10.49	10.95	
September	9.75	13.78	10.25	11.93	11.54	
October	9.85	12.06	10.98	12.44	12.00	
November	10.43	11.02	11.25	12.50	12.00	
December	11.00	10.24	11.25	12.50	12.00	
Average	9.71	13.39	10.22	11.20	11.53	

Zinc at New York, Cents a Pound

	1929	1932	1933	1934	1935	1938
January	6.70	3.38	3.38	4.62	4.08	5.22
February	6.70	3.19	3.04	4.73	4.06	5.23
March	6.80	3.16	3.37	4.72	4.25	5.27
April	7.04	3.10	3.68	4.72	4.38	5.27
May	6.98	2.90	4.17	4.71	4.60	5.27
June	7.00	3.16	4.70	4.59	4.67	5.26
July	7.10	2.92	5.24	4.68	4.70	5.16
August	7.15	3.13	5.28	4.63	4.92	5.17
September	7.15	3.68	5.08	4.43	5.04	5.22
October	7.09	3.41	5.12	4.19	5.21	5.22
November	6.83	3.46	4.87	4.08	5.23	5.35
December	6.09	3.50	4.82	4.06	5.22	5.64
Average	6.87	3.25	4.40	4.51	4.70	5.27

	1937	1938	1939	1940	1941	1944
January	6.20	5.35	4.89	6.03	7.65	1943
February	6.80	5.17	4.89	5.93	7.65	1942
March	7.75	4.77	4.89	6.14	7.65	price
April	7.70	4.53	4.89	6.14	7.65	fixed
May	7.10	4.43	4.89	6.20	7.65	at
June	7.10	4.53	4.89	6.83	7.65	8.65
July	7.27	5.14	4.91	6.64	7.65	
August	7.56	5.14	5.11	6.79	7.65	
September	7.54	5.24	6.51	7.33	7.65	
October	6.45	5.40	6.89	7.64	8.36	
November	5.98	5.12	6.89	7.64	8.65	
December	5.36	4.89	6.46	7.65	8.65	
Average	6.90	4.98	5.51	6.73	7.88	



New Methods in industry impose new demands on assembly lines . . . for a new measure of economy through *faster, safer, easier,* and *better* production. Wherever power driving is used, the records show that CLUTCH HEAD Screws scale down the final costs with modern features and advantages which are *not matched by any other screw on the market today.*

VISIBILITY . . . The wide Clutch recess offers a clear, definite target, inviting confidence and unwavering action by the "greenest" operator. No "breaking-in" required.

SAFETY . . . The Center Pivot on the driver makes deep dead-center entry automatic. No canting, no slippage to injure manpower or damage materials.

EFFORTLESS DRIVING . . . The straight-sided driver squarely contacts the full area of the straight-walled Clutch to eliminate end pressure as a hazard and as a fatigue factor. With CLUTCH HEAD, there is no ride-out tendency as set up by "tapered" driving.

CLUTCH HEAD LOCK-ON . . . A slight reverse turn creates a friction-hold which unites screw and driver as a unit for easy one-handed reaching to hard-to-get-at spots. No slow-down fumbling. With field service Type "A" Bits, this feature functions automatically for easy withdrawal of screws, undamaged and saved for re-use.

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This is the only modern screw engineered for operation with ordinary type screw drivers or any flat blade of reasonably accurate width. Thickness of the blade is secondary because the roomy Clutch permits a wide tolerance.

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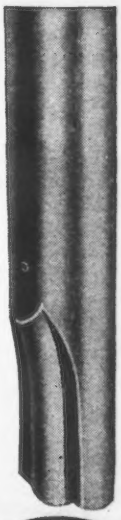

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Sales and Service in 181 cities.

TOLEDO
PRINTWEIGH
SCALES

Lead at New York, Cents a Pound

	1929	1932	1933	1934	1935	1936
January	6.65	3.75	3.00	4.00	3.6	4.50
February	6.85	3.72	3.00	4.00	3.5	4.51
March	7.41	3.15	3.15	4.00	3.5	4.50
April	7.19	3.00	3.27	4.18	3.6	4.50
May	7.00	3.00	3.65	4.14	3.98	4.50
June	7.00	2.99	4.17	3.98	4.02	4.50
July	6.80	2.73	4.46	3.77	4.12	4.50
August	6.75	3.24	4.50	3.75	4.25	4.50
September	6.88	3.47	4.50	3.68	4.41	4.50
October	6.87	3.05	4.32	3.65	4.51	4.63
November	6.29	3.04	4.29	3.57	4.56	5.11
December	6.25	3.00	4.14	3.60	4.50	5.55
Average	6.83	3.18	3.87	3.86	4.06	4.71

	1937	1938	1939	1940	1941	
January	6.00	4.87	4.83	5.47	5.50	1944
February	6.23	4.83	4.80	5.08	5.60	1943
March	7.19	4.50	4.82	5.19	5.77	1942
April	6.32	4.50	4.78	5.07	5.85	price
May	6.00	4.40	4.75	5.02	5.85	fixed
June	6.00	4.15	4.80	5.00	5.85	at
July	6.00	4.88	4.85	5.00	5.85	6.50
August	6.45	4.90	5.04	4.85	5.85	
September	6.40	5.00	5.45	4.93	5.85	
October	5.75	5.10	5.50	5.31	5.85	
November	5.03	5.09	5.50	5.73	5.85	
December	4.87	4.84	5.50	5.50	5.85	
Average	6.02	4.74	5.05	5.18	5.79	

Straits Tin at New York, Cents a Pound

	1929	1932	1933	1934	1935	1936
January	49.21	21.80	22.70	51.98	50.91	47.23
February	49.39	21.97	23.51	51.78	49.96	47.94
March	48.85	21.81	24.35	53.84	48.88	48.00
April	45.93	19.17	27.16	55.66	50.05	46.97
May	43.88	20.90	35.94	53.57	51.10	46.31
June	44.20	19.58	44.23	51.31	51.08	42.24
July	46.29	20.89	46.28	51.94	52.31	42.96
August	46.60	22.98	44.71	51.99	50.46	42.57
September	45.32	24.76	46.46	51.52	49.05	44.77
October	42.25	23.91	47.95	51.01	51.25	44.95
November	40.18	23.31	52.14	51.24	51.82	51.30
December	39.87	22.70	52.91	50.92	49.77	51.85
Average	45.16	21.98	39.12	52.23	50.39	46.42

	1937	1938	1939	1940	1941	
January	50.90	41.54	46.39	46.73	50.16	1944
February	52.10	41.23	45.64	45.85	51.41	1943
March	52.74	41.16	46.17	47.07	52.07	1942
April	59.02	38.41	47.16	46.96	52.03	price
May	55.64	36.83	49.00	51.51	52.18	fixed
June	55.88	40.36	48.81	54.64	52.68	at
July	59.34	43.38	48.53	51.61	53.41	52.00
August	59.40	43.28	48.80	51.21	52.45	
September	58.64	43.40	Nom.	50.30	52.00	
October	51.52	45.25	55.68	51.50	52.00	
November	43.34	46.29	52.65	50.57	52.00	
December	42.96	46.21	51.40	50.11	52.00	
Average	54.29	42.28	49.11	49.84	52.03	

Magnesium
Cents a Lb., 99.8%, at New York

1929	56	1934	26	1939	27
1930	48	1935	30	1940	27
1931	34	1936	30	1941	27
1932	29	1937	30	1942	22.50
1933	28	1938	30	1943	20.50
				1944	20.50

Virgin Aluminum, 99% Plus, Delivered Cents a Pound

	1929	1932	1933	1934	1935	1936
January	23.90	23.30	23.30	23.30	20.50	20.50
February	23.90	23.30	23.30	21.65	20.50	20.50
March	23.90	23.30	23.30	21.65	20.50	20.50
April	23.90	23.30	23.30	21.65	20.50	20.50
May	23.90	23.30	23.30	21.65	20.50	20.50
June	23.90	23.30	23.30	21.65	20.50	20.50
July	23.90	23.30	23.30	21.65	20.50	20.50
August	23.90	23.30	23.30	21.65	20.50	20.50
September	23.90	23.30	23.30	21.65	20.50	20.50
October	23.90	23.30	23.30	21.49	20.50	20.50
November	23.90	23.30	23.30	20.50	20.50	20.50
December	23.90	23.30	23.30	20.50	20.50	20.50
Average	23.90	23.30	23.30	21.58	20.50	20.50

	1937	1938	1939	1940	1941	
January	20.50	20.00	20.00	20.00	17.00	1944
February	20.50	20.00	20.00	20.00	17.00	1943
March	20.00	20.00	20.00	20.00	17.00	1942
April	20.00	20.00	20.00	20.00	17.00	price
May	20.00	20.00	20.00	20.00	17.00	fixed
June	20.00	20.00	20.00	20.00	17.00	at
July	20.00	20.00	20.00	20.00	17.00	16.00
August	20.00	20.00	20.00	20.00	17.00	
September	20.00	20.00	20.00	20.00	17.00	
October	20.00	20.00	20.00	20.00	16.00	
November	20.00	20.00	20.00	20.00	16.00	
December	20.00	20.00	20.00	20.00	16.00	
Average	20.08	20.00	20.00	20.00	16.87	

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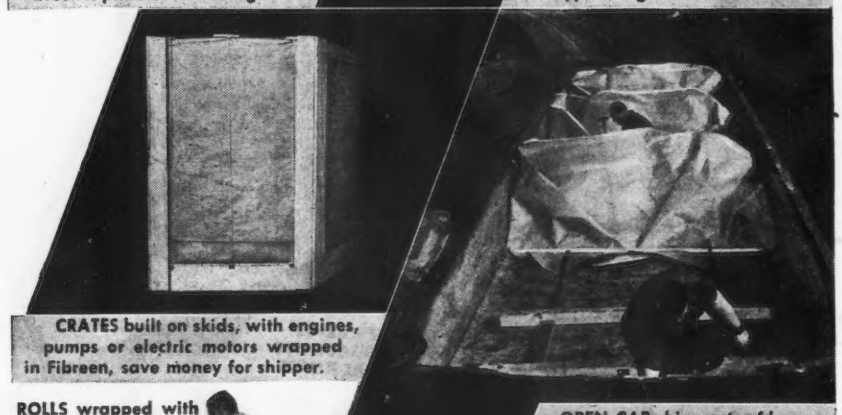

CRATES built on skids, with engines, pumps or electric motors wrapped in Fibreen, save money for shipper.

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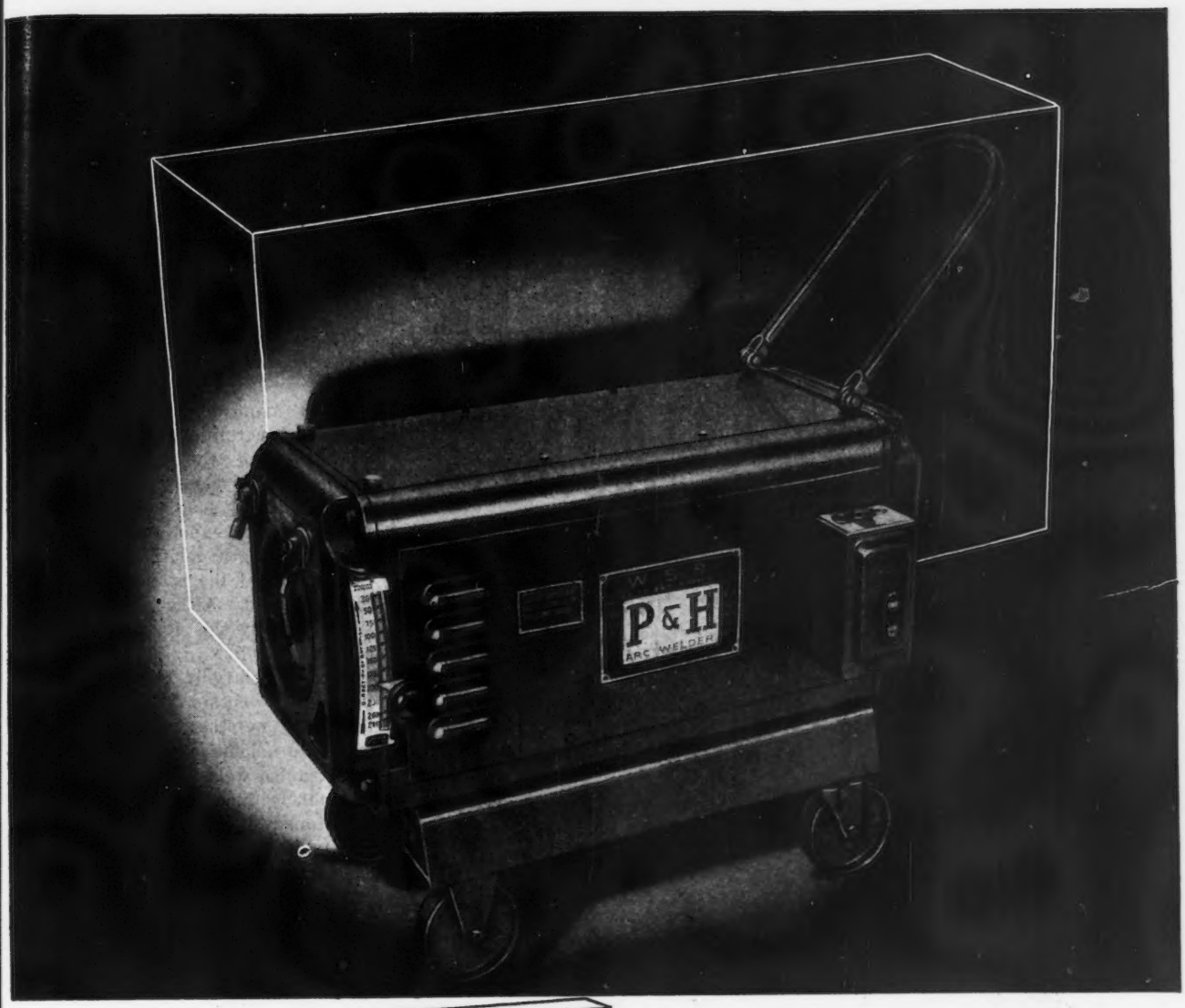
Welding

(CONTINUED FROM PAGE 85)

ductility in the steel. In general it was found that at various temperatures large welded specimens made of about as thick plate as is ever encountered in shipbuilding were able to sustain loads equal to the full capacity of the steel and undergo elongation almost equal to that of the virgin base metal. Charpy notch bar impact values of Unionmelt weld metal at —20 deg. F. were equal or superior to those of the rolled steel. Bibber concluded that the metal in the welded joint is no less tough than that of the virgin base metal and no more likely to instigate crack propagation. Like others he thought it safe to assume that all the as-welded specimens contained residual stress of the magnitude of 45,000 to 50,000 lb. per sq. in., but even when such welded plate was tested at low temperatures, it was capable of developing the full ultimate strength and elongation obtained from a virgin base metal specimen, certainly far more strength and elongation than the joint would be called upon to develop in a ship. Summarizing the date he pointed out that without severe notches, it was not possible to set up a state of stress that would cause a brittle failure to occur in a welded structure of heavy ship plate, although an approach to this state was clearly shown. There was always some plastic flow present, although the addition of transverse locked-up stress caused by external restraint resulting from rigid welding procedure reduced the ability to flow plastically and hence the elongation. This latter phase, incidentally, is a subject that is under study by another group at the present time.

Stress Relief Studies

It is well known that locked-in stresses from the thermal effects of welding can be reduced to a safe value by stress relieving the entire structure at 1200 deg. F. in a furnace —a practice obviously impractical for a large structure like a ship. On the other hand, the application of local high temperature relief is ineffective and frequently detrimental. Over a year ago a new method of relieving these stresses was worked out by Harry E. Kennedy of Berkeley, Calif., and has since been checked by an investigation carried on at Sun Shipbuilding & Dry Dock Co., in co-



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1. SIMPLER CONSTRUCTION — only two major parts, a rigid one-piece frame and husky, rotating member. Single heat control. No complicated attachments. There is less to go wrong.

2. MORE COMPACT, EFFICIENT — it's entirely self-contained, self-excited, internally stabilized. The last word in simplicity, compactness, and ease of operation.

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4. A MORE FLEXIBLE WELDING SERVICE — double-decked with parallel connection, as shown at right, you have a much wider welding range.

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6. WSR (Welding Service Range) Ratings give you the machine's actual delivered output — the *usable* welding heat from minimum to maximum.

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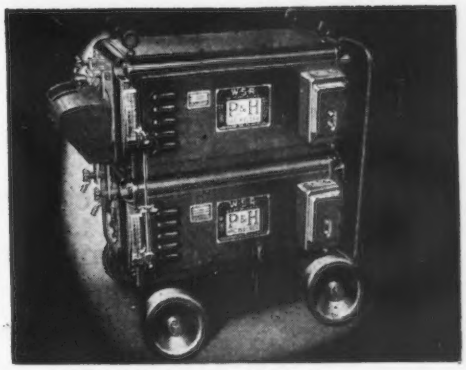

When machines are stacked and connected in parallel, one operator may have the combined welding capacity of two machines. Or, two operators have separate services, the equivalent of one machine each.

P&H manufactures a complete line of welding electrodes for both AC and DC use, including types for hard-surfacing, resistance to wear, impact, and abrasion as well as for all mild and alloy steel applications. Write for literature.

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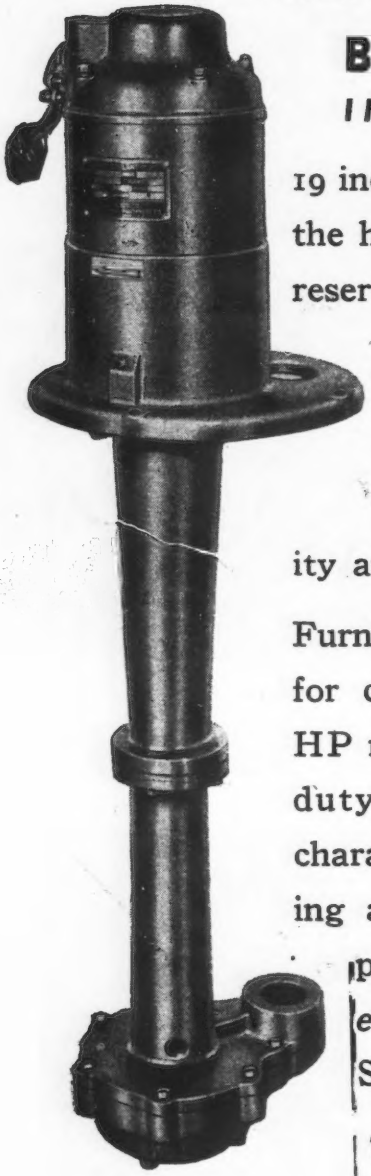
a new DEEP-IMMERSION GUSHER COOLANT PUMP

BY RUTHMAN

IN TWO LENGTHS



19 inches and 23 inches below the high level line of coolant reservoir. Model HL-15025-B has been produced to meet the need of machine tool requirements for greater tank capacity and utility of floor space.

Furnished with 1/4 HP motor for continuous duty and 1/2 HP motor for extra heavy duty, in standard current characteristics. Entire rotating assembly on heavy one-piece ground shaft is *electronically* balanced. Simple installation.

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operation with the Linde Air Products Co.

Welds made both manually and by the Unionmelt process were found to produce longitudinal stresses of yield point value even in small weldments, whether the plates were constrained mechanically or not. During the formation of these stresses, considerable plastic deformation or upsetting takes place, but to release these stresses only a relatively small change in length or dimension of the weld is required, of the order of 0.0015 in. per in. in length of weld. Inasmuch as the weld metal is strained to its yield point, any small application of load will stretch it plastically and upon release of the load the length relationship will be improved and the stress correspondingly reduced. Although it is impossible to apply this form of mechanical stress relief in large structures (peening is largely ineffective) it is possible to obtain the same effect thermally by the application of a moderate amount of heat adjacent to the strained weld zone. This desired thermal loading is accomplished by simultaneously heating a band on each side of the weld, using special oxyacetylene heating torches traveling at about 16 in. per min. The temperature differential required to develop sufficient force to effect complete relief can be obtained by the use of temperatures not in excess of 350-400 deg. F.—insufficient to produce any metallurgical changes in the metal.

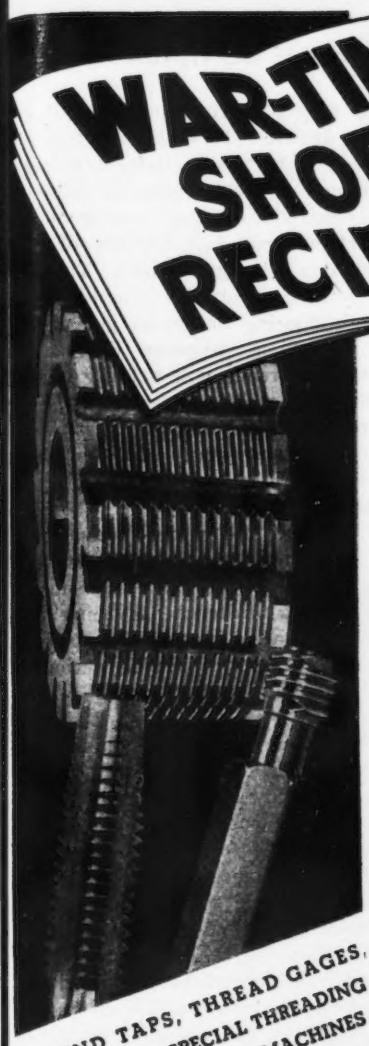
Tests show that after the controlled temperature stress relief, the average stresses in the weld are less than 10 per cent of the residual longitudinal stresses in the as-welded condition and are comparable with those obtained by full furnace relief at 1150 deg. F.

Electrode Specifications

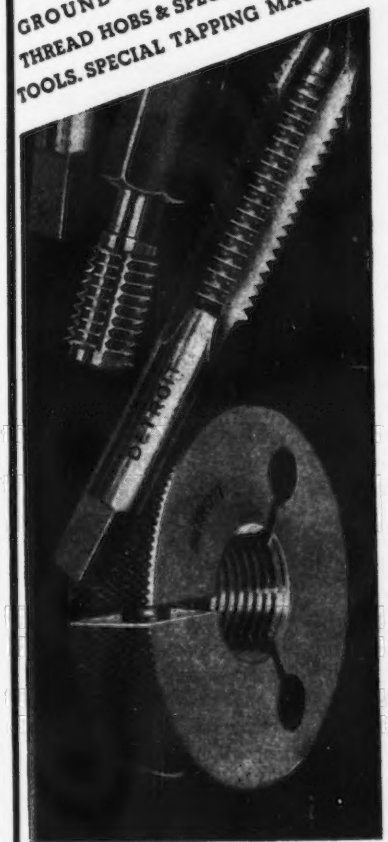
For the past year there has been a movement on foot to tighten the specifications on welding electrodes. To a large extent the Tentative Specifications for Iron and Steel Arc Welding Electrodes (ASTM-AWS serial designation A233-42T) have been accepted by industry so that today a specification number like E-6010 is as familiar as SAE 1020. Pressure for revision is coming rather from the electrode manufacturers themselves acting through the AWS Filler Metal Specifications Committee. The main object of drawing tighter specifications is to eliminate dual classifications of the same electrodes, although

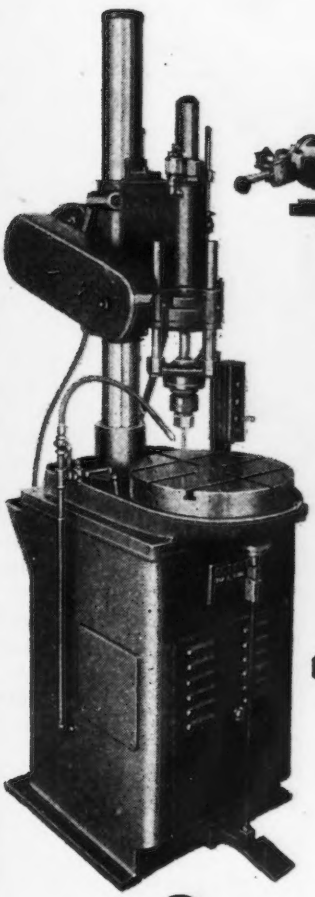
WAR-TIME SHOP RECIPES

4 WAYS TO CUT BETTER THREADS



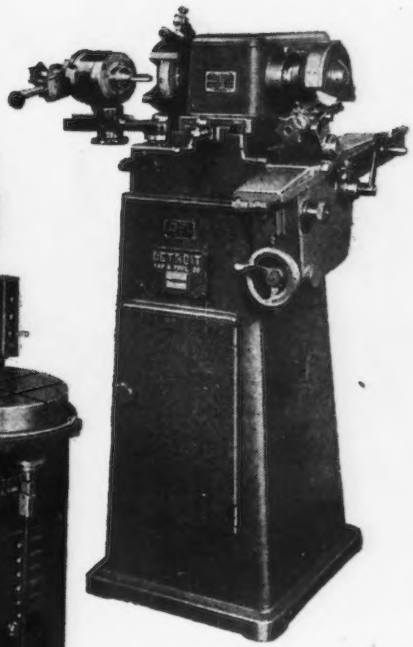
GROUND TAPS, THREAD GAGES, THREAD HOBS & SPECIAL THREADING TOOLS. SPECIAL TAPPING MACHINES





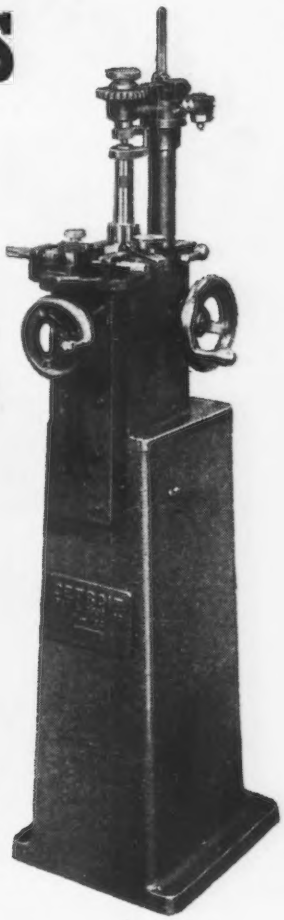
3

Use a "Detroit" Lead Screw Type Tapping Machine
(Light Duty Type Shown)
Ask for Bulletin LTM-44



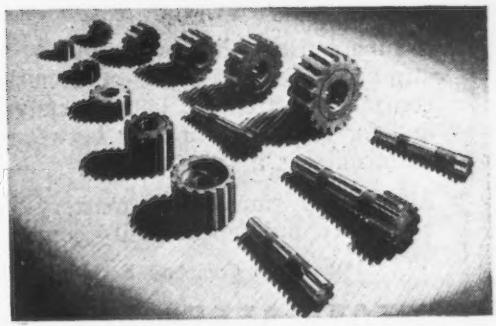
2

Sharpen your taps on the "Detroit" 4 in 1 Tap Reconditioner
Ask for Bulletin DTR-3



1

Check your Thread Milling Cutters on the "Detroit" Hook & Spacing Checker
Ask for Bulletin HC-43



4

Specify Thread Milling Cutters ground from STANDARD Blanks carried in Stock
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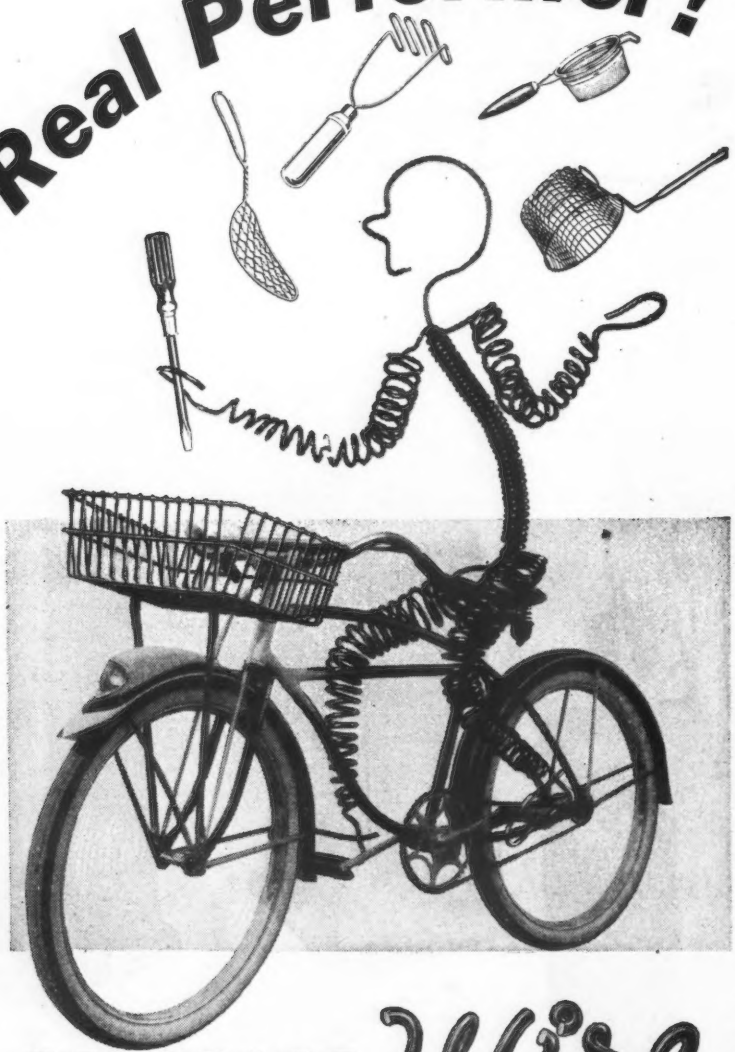
A Real Performer!



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—*used in* ANDROCK products

It's a broad field—small hardware, display racks, kitchen utensils and many special war items—covered by products carrying the well-known name of "Androck*". Into this quality line go hundreds of tons of Keystone wire.

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some of the distinctions are rather finely drawn. To this end, for instance, tests for satisfactory performance of E-6010 reverse polarity d.c. electrode or the corresponding E-6011 a.c. rod call for one of the test plates being galvanized. The arc from these electrodes should have enough digging action to get under the zinc films, whereas E-6012 or E-6013 electrodes will not dig under because of the lower voltages employed. Similarly in the fillet weld tests, fillet sizes are called for that will definitely segregate certain types of electrodes.

In general the revised standards will stress tensile strength, ductility, elongation and usability. Much more rigid testing procedure is being incorporated to isolate usability factor.

For a while it appeared probable that the E-6013 classification would be dropped since it is difficult to devise a test that will distinguish this electrode from the E-6012. Both are all-position low voltage rods, with spray type deposit with light penetration intended for poor fit-up work. Sheet metal fabricators, on the other hand, would like to see the E-6013 electrode singled out for light gage steel applications, although no test has yet been devised to make a clear differentiation between this electrode and E-6012. The present tentative specification is of no help on this score.

In this connection, some improved types of E-6013 electrodes have been developed that show great promise for light gage work. With a coating formulated for light penetration, it has been possible to use 3/16 in. electrodes and lay down a fillet head at a rate of 24 in. per min. between 16 gage steel sheets. In fact, it is this type of electrode that has largely contributed to the successful mass production of some of the army's amphibious vehicles. In these units, the main problem is to enclose a modified truck chassis in a watertight compartment. As much as 1500 ft. of sealing welds are made in one of the most popular types. Extension of arc welding of light gage steel with this type of electrode is seen in the postwar period to fabricating truck and trailer units and in railroad freight and passenger car construction—in both fields of transportation equipment in competition with spot welding, of course.

It is interesting to note that AWS E-6013 electrodes are meeting Army Air Force requirements in the butt welding of SAE X-4130 aircraft tub-

100 CASE HISTORIES

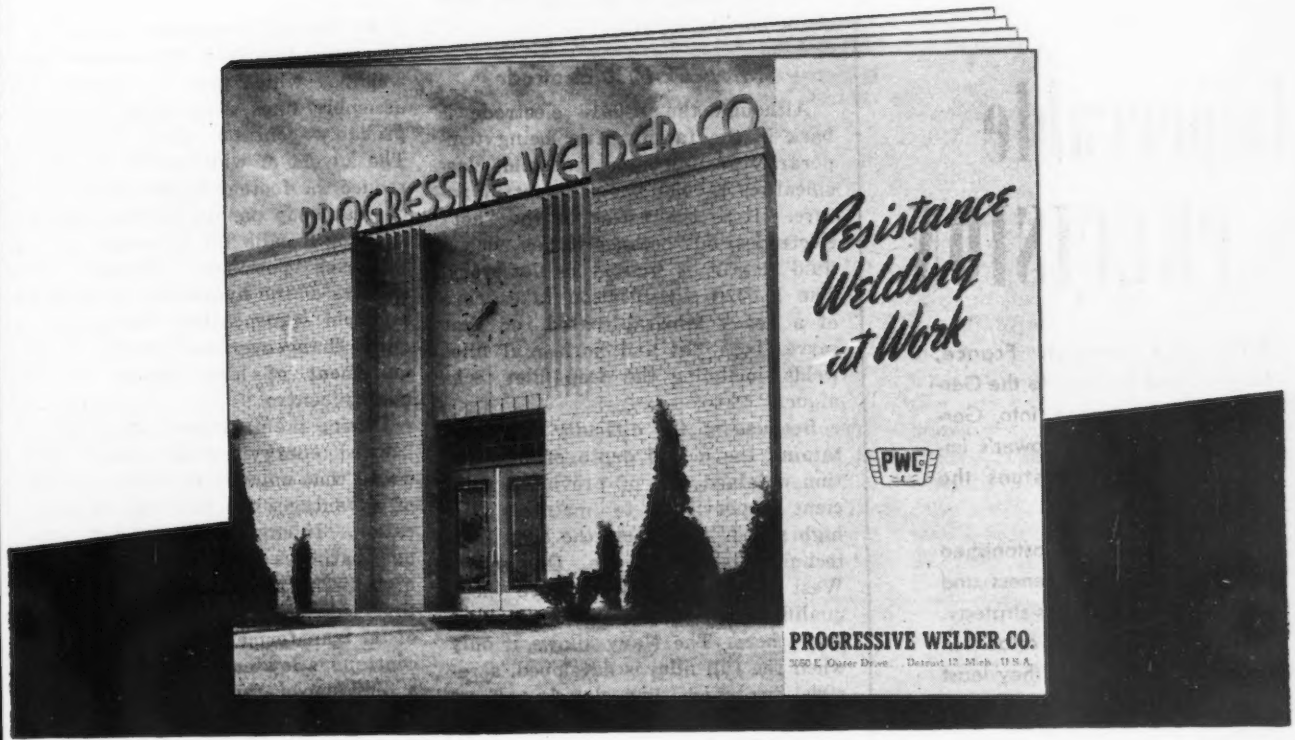
of typical applications in Industry of

"PORTABLE" WELDING

1. Portable machines
2. Push guns
3. Scissors guns
4. "C" type guns
5. Pinch type guns
6. Special guns
7. Portable Seam Welders

"STATIONARY" WELDING

1. Pedestal Spot welders
2. Rocker arm welders
3. "Temp-A-Trol" welders
4. Projection welders
5. Multi-spot welders
6. Seam welders
7. Special Uses of Welders



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Plus a section on Welding & Assembly Fixtures

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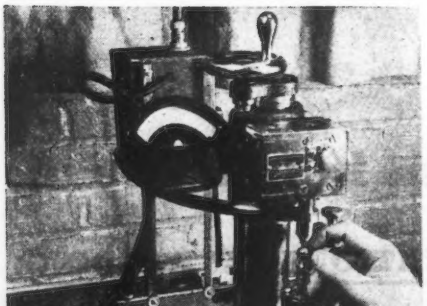

Here is an illustration of the P. and W. Electro-limit Gauge. In this machine, the sphericity of the balls to the required dimensions is checked to finer than .000025" tolerance.

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ing in the normalized condition such as is used for aircraft engine mounts. Recently reported tests indicate that when such weldments are heat treated to 150,000 lb. tensile strength or higher (for the parent metal) the weld deposit made with this low carbon electrode has superior impact values to deposits made by the higher alloy ferritic rods. The alloy filler metals yield higher impact strengths in the as-welded condition, however, and since they have better weldability characteristics as compared to E-6013, particularly as regards susceptibility to cracking, it may be found desirable to use these electrodes for weldments subject to considerable strength and rigidity such as in landing struts.

Status of E-6030 Electrode

Although the E-6013 electrode is back in the family after being temporarily an unwanted stepchild, classification E-6030 has a doubtful future. It is the hotter of the "hot" electrodes, but because it has such a fluid slag it is limited to flat work. The E-6020 classification takes care of a heavy mineral coated rod that serves both flat and horizontal fillet welds, including the deep fillet technique.

Because of the difficulty of ascertaining the actual depth of penetration obtained and of providing sufficient supervision to maintain the high speeds necessary, the deep fillet technique is on the wane. One or two West Coast shipyards have been qualified to use this technique, but few others. The Navy allows it only when the full fillet is developed, a restriction which immediately offsets the claim of equal strength with smaller fillet size as a result of more base metal being melted. Commercially the heat is off the process and companies who a year ago were making counterclaims as to being "first" have mostly ceased to plug this line.

High speed welding of sheet metal is also being currently attained through application of the submerged melt welding process. As an example, tubular shell containers of 14 and 16 gage are being welded on the longitudinal seam at speeds from 130 to 209 in. per min. Experimentally thin sheets are being welded together on edge with this technique and attempts are being made to replace atomic hydrogen welding of propeller blade edges with the submerged melt welding process.

This is a process that was initially developed for welding ship plate and it still finds its largest use in this field. In the past year its application has been extended into the mass production of heavy duty automotive equipment. One of the biggest installations is on bogey wheels for tanks and tank destroyers. In fact, on any circular work that can be revolved in a fixture automatic processes are replacing the manual welds that were used in the initial programs. Turbo-supercharger buckets are fastened to the rotor in this manner with austenitic welds. Submerged melt welding is also being adapted to work that was automatically welded by the carbon arc or by flash butt welding, such as banjo rear axle housings for trucks.

As far as automobile bodies are concerned the trend toward more spot welding which set in before the assembly lines were shut down will probably continue after V-E Day. The advent of wider sheets tended to reduce the footage of flash butt welds on rear body panels, but the need for speed still calls for automatic setups wherever possible. Multiple spot welders of the hydromatic type firing in rapid sequence lend themselves to quick changeover and satisfy the requirement of high production and quality control.

During the past year a new type of "stored energy" welder was introduced that appears to have a number of advantages for this type of application. It employs heavy duty storage batteries capable of sustaining high discharge rates directly through the electrodes without the necessity of a transformer. Operating at a continuous low current charge, it has a high power factor and simple control equipment. With hydromatic heads, a unit of this kind is capable of making as many as 20 spots in autobody stock in less than a second by firing the electrodes in the order of 7-6-7 from a bank of three storage batteries connected in rapid rotation. Ordinarily, each head in a multiple hydromatic setup must be fired successively, one at a time.

Spot Welding Heavy Gages

Spot welding of heavy gage materials has shown considerable progress in the past year. Even before the war, structural steel units were being fabricated on the Continent by resistance welding and while the big hurdles here are building codes, engineering acceptance and the general inertia of the fabricators, some progress is being made in automotive ap-

(CONTINUED ON PAGE 182)

Export

(CONTINUED FROM PAGE 103)

and 3.5 per cent had less than 200 workers. In 35 per cent, exports were under the direction of an official of the domestic sales department. Here the breakdown is 26 per cent of companies handling exports in this manner had a labor force of over 500, 43.5 per cent employed between 200 and 500 and 30.5 per cent employed less than 200. The services of an outside export agency were utilized by 19.5 per cent. Of this group, 54 per cent employed less than 200, 15.5 per cent employed between 200 and 500 and 30.5 per cent employed more than 500.

After the war, 19 per cent of those that exported before the war intend to change their means of handling export business. Half intend to establish an export department, thus indicating a more serious pursual of foreign business, 25 per cent will leave exports to an official of the domestic sales department, 16.5 per cent will use an outside export organization and 8.5 per cent will work with a separate export organization.

Export shipments during the war years have been maintained by 34 per cent, while 22 per cent reported increased shipments due mainly to lend-lease activity. Seventy-seven per cent have been unable to maintain prewar levels of foreign shipments. Decreased shipments were reported by 51 per cent, no export trade at all by 31 per cent and no foreign sales other than lend-lease by 18 per cent.

As for the extension of credit to foreign purchasers, 48 per cent had not followed this practice while 52 per cent did. Of this 52 per cent, 21.5 per cent reported no losses from foreign debtors, 67 per cent reported such losses to be less than their domestic losses; 8.5 per cent found foreign and domestic losses to be equal and 3 per cent found foreign losses to be greater than those from domestic debtors. After the war, 46.5 per cent of the participating companies plan to extend the same credit terms for export as they do for domestic sales.

Lend-lease shipments and the export of equipment by the Army and Navy for use of American forces overseas were found to have attracted the interest of foreign purchasers by 39 per cent of the cooperating companies. In most cases this was manifested by inquiries as to the availability of products for non-lend-lease sales.

In preparing for postwar export trade, 49.5 per cent intend to allocate definite quantities of output for export. The remainder, or little more than half, do not plan to have rigid export schedules.

To discover the more generalized attitudes on export policies as a whole, one of the questions asked related to an opinion of the effect on American industry of the present movement towards industrialization of backward countries. This is considered beneficial to the United States by 78.5 per cent since it would increase the demand for American products; 7 per cent thought it would be profitable for American business only during the period of construction; 2.5 per cent doubted whether any benefits would accrue to the United States, and 12 per cent believed that the effects of such industrialization would in no way help the United States.

Government aid in the form of subsidies were favored by 43 per cent who thought it would be advantageous to American industry in competing for foreign markets. Fifty-four per cent opposed this and 3 per cent thought such a practice might be helpful for some commodities only.

Government allocations of quantities to be exported were opposed by 82.5 per cent of those answering while a few volunteered the opinion that the only government control needed would involve technical quality. Standardization of quality was also listed as an advantage of an intra-industry organization for export purposes. In favor of such an organization were 35.5 per cent while 64.5 per cent opposed such a group, saying that it would tend to be restrictive to competition.

As for willingness to extend long term credit terms to the USSR, for which precedent has already been set on the part of one large producer, 7.5 per cent are agreeable to the extension of such long terms credits to Russia, 86.5 per cent would not, or could not, be willing and 6 per cent said they would extend short credit terms only.

Principal competitors for world markets were Great Britain and Germany. Other major competitors were France, Italy, Canada, Sweden, Japan, Switzerland, Belgium, Holland, Argentina and Australia. In the five years 1936-40, these countries took close to two billion dollars of American exports, or 60 per cent of American exports to all countries.

That these countries were recipients of such a major share of American products would indicate that American business can take its place in the international picture, with no fears as to its ability to meet competition and yet maintain its high living standards. But the problems the United States faces are magnified in countries like Great Britain that are fully aware that to exist as a healthy nation they must find foreign markets for their produce.

Metal Finishing

(CONTINUED FROM PAGE 99)

grams per sq. in. The underlying metal coats will vary from a few ten thousandths to one or two thousandths of an inch in thickness.

Electroforming, or the creation of metallic articles by electrodeposition, has numerous industrial applications, although knowledge of the specific techniques involved is not widespread. Yet a listing of some of the more recent applications of the process demonstrates that, in electroforming, industry has acquired a new engineering tool. An interesting paper on this subject was "Eltroforming Techniques," by Savage, which was awarded the Founders' Gold Medal as second prize for the best papers read at the 1944 convention meeting of the American Electroplaters' Society.

The process is in operation for the manufacture of sound record masters, metal screens, electrotypes, caskets, patterns, master coin dies, dies for molding rubber, glass and plastics, duplicate intaglio printed plates, mirror reflectors, pipe fittings, seamless copper tanks, float balls for pressure gages and transformer cores. Recently, band instruments such as cornets and trumpet bells were electroformed, and later trombone bells and trombone slides. The last named were produced by first electroforming tubing over slightly tapered chromium plated steel mandrels, and then drawing the tubes out with 100 per cent elongation.

Probably the most interesting and most difficult job was the electroforming of tympanic bowls or kettle drums. These varied from 25 in. to 29 in. in diameter and from 18 in. to 22 in. deep with a hemispherical bottom and straight sides. Valve assemblies with

three valve casings and all parts assembled have been experimentally produced in one piece. Techniques for electroforming have been worked out for copper, nickel, silver, iron, brass and alloys of cobalt and nickel.

A very interesting development was a process for producing a bright alloy plate, a ternary alloy deposit of copper, tin and zinc. The process, on which patents are pending, was developed by Westinghouse Electric & Mfg. Co., Meter Division, Newark, N. J., to meet military requirements for which existing single metal or binary deposits were not adequate. G. W. Jernstedt was responsible for a major share of the investigation on which the process is based. The Hanson-Van Winkle-Munning Co. is cooperating with Westinghouse to market the process.

The deposited alloy of copper, tin and zinc is a bright blue-white as it is taken from the plating solution. It is hard and wear-resistant, has excellent tarnish-resistant qualities, is non-magnetic and has a high protective value when applied over copper or copper alloys.

Corrosion resistance is its outstanding property. When the alloy is plated on brass or copper base metals, at a thickness of only 0.0002 in., it will pass the 200-hour salt spray test. If the base metal is steel and corrosion protection, the prime requisite, direct plating is not recommended. A copper undercoating should first be applied in order to secure the benefits of the low corrosion rates between the bright alloy and the copper. Its reflectivity approaches silver (80 to 85 per cent).

Interesting light on the structure of electroplates was thrown by Zappfe and Faust who showed that the so-called aging of electroplates is a double phenomenon involving both the plate and the basis metal. A brittle plate thus may age into ductility by losing its hydrogen into the atmosphere, whereas a ductile plate may actually "age" into brittleness when the same dehydrogenizing action occurring in the underlying metal throws a detrimental quantity of that gas into the overlying plate. In the same manner for gas pitting, those gas bubbles on the cathode often described as "unusually adherent" are in reality the result of gas issuing not from the electrolyte, but from the basis metal.

Some interesting developments were disclosed through patents and other avenues of information during the past two years.

Zinc and iron show greatly improved corrosion resistance, according to Jernstedt after a predip containing ½ per cent disodium phosphate activated with a titanium compound, used before phosphating.

Magnesium and its alloys may be given good resistance to sea water, as reported by Parkinson & Cuthbets, using alternating current in a weak chromic acid solution at low current density.

Buzzard was granted a patent on a method involving treatment anodically or with alternating current in a non-alkaline solution of chromate and sulfate.

Plating on aluminum by the Krome Alurze process, now includes the use of 0.25 per cent HFL as a modifying dip after anodizing in oxalic acid with alternating current.

The large increase in the use of zinc plating has focussed attention again on problem of cooling barrel solutions, since higher current inputs are involved for barrel zinc plating than for most commonly used solutions, and the solution consequently heats up above its optimum temperature.

Wise and Vines patented a chloride bath for plating palladium, containing an appreciable amount of free HCL, to produce thick, ductile deposits.

Continuous nickel plating of fine iron wire for electric light leads is now being done on a large scale. A method has been patented of depositing nickel followed by zinc and heating to an alloying temperature of the two, but a temperature insufficient to cause appreciable alloying of the nickel with the ferrous base. Nickel deposits of 400 Vickers hardness were said to be obtainable from a solution containing ammonium ions and nickel, and operated at high current densities.

Schaefer and Mohler developed a high speed silver bath which could tolerate cast silver anodes. On rotating cylinder cathodes such as bearings, a dense ductile deposit could be obtained in a cyanide solution operated at relatively high pH and with rather high metal concentration. Bowen and Gilbertson found that thin, adherent deposits of silver could be obtained on magnesium with the use of a boric acid — cyanide solution, after proper treatment of the magnesium base.

Various methods were suggested for plating zinc on malleable and gray iron castings: cadmium flashing; mercury and cadmium in the zinc solution; tin flashing; high carbonate zinc bath flashing at high current density; immersion in molten caustic soda and anodizing in NaCl prior to zinc plating.

An important disclosure was made by F. Page, Jr., who presented evidence indicating that zinc must not be permitted in contact with stressed steels or stainless steels at elevated temperatures because cracking of the metal results from the solution of iron by the zinc along the grain boundaries. Consequently, although zinc is being substituted for the more scarce cadmium as a protective coating for most purposes, cadmium is still specified for engine parts operated at elevated temperatures or in contact with components operating at such temperatures.

Organic Finishes

Painting for purely decorative purposes has been largely dispensed with during the war, but the application of organic coatings for corrosion resistance and other protective purposes is an important war requirement. Colored coatings are restricted to identification and camouflage.

Organic finishes and coatings are made from hundreds of raw materials, such as synthetic resins, natural resins, drying and non-drying oils, plasticisers, cellulose derivatives, chlorinated rubber, pigments, driers and solvents. The synthetic resins draw on such chemicals as urea, formaldehyde, mallic anhydride, phenols and their derivatives, polyhydric alcohols, modifying oils, sebacic acid and many others. Most of these materials are needed for war products and the WPB has consequently placed practically all of these materials under Conservation and Allocations Orders seriously limiting their availability to the manufacturers of non-essential products.

New materials of considerable merit have been developed to substitute for the restricted materials, but as rapidly as they show promise of having valuable coating characteristics, they are often in turn, allocated to war uses, or the materials from which they are derived become critical. The value of the substitutes will not cease after the war, but much of the value will be held in abeyance till then.

Instances of finishes which have been developed as wartime replacements are numerous. Pearl essence is used to substitute for metal powder finishes on everything from women's compacts and cosmetic containers to heavy industrial equipment and machinery. Very fine results have been obtained, both with one coat and with

two coat systems. Brass, copper, gold and metal plates have been simulated by spraying, air drying, or baking transparent lacquers and synthetic finishes over highly polished steel and other metals. There have even been requests to simulate brass over wood and black iron, a very difficult performance because it is the brilliance of the basis metal which is directly responsible for the brilliance of the finished product.

A material currently of great importance is the zinc chromate primer for its moisture-resistant and protective qualities. The Navy has used zinc chromate primer P27 for many years and today requires a thin coat on all work before the application of any other materials. The specifications are rigid, the severest being the settling test. The Army also used a zinc chromate primer No. 14080, the specifications for which allowed the manufacturer somewhat more latitude than the Navy in formulation, although the performance specifications were the same. In July, 1941, both departments got together on an identical specification; AN-TT-P-056 was issued for both Army and Navy work under the government plan of consolidation and simplification of specification; superseding both P27 and No. 14080. However, the Navy later informed the industry that it was returning to the P27 zinc chromate primer.

The great advance in range altitude, speed and power of our aircraft has called for finishes that would stand the steaming heat of the tropics and equally well, the clear dry cold of the stratosphere. Radios and equipment required insulating varnishes and coatings which would insulate and remain flexible at low temperatures.

The first requirement is a primer which will inhibit corrosion and at the same time act as a bond between the bonderized or anodized metal and subsequent coatings. For this, as previously noted, both Army and Navy use zinc chromate primer. The chromate primer is followed by one or two coats of lacquer or synthetic enamel, generally cellulose nitrate lacquers fortified with glyceryl phthalate resins. Both Army and Navy specifications include glossy and non-specular or lusterless lacquers and enamels.

Besides corrosion resistance the government has required finishing materials which could be used for camouflage. These called for certain other properties in addition to those of corrosion resistance. Low visibility to the human eye, of course, was a primary requirement. Under some circumstances, invisibility to the infra-red films used in aerial cameras was also requisite. Moreover, this is no static requirement, for with the seasons, this infra-red reflectance changes and the paints and lacquers must meet these changes.

For the camouflage of tanks, trucks, large guns and automobiles for the Army, the Holabird Motor Base, U. S. Army Ordnance Specifications ES680A supply camouflage and corrosion resistance properties that are approved for almost every purpose. The olive drab enamel used is lustreless, of low visibility and non-specular reflection. It retains these properties and does not polish when rubbed. It is applied over a zinc chromate and red oxide combination which the ES680A class 101 specification calls for.

Sometimes trucks, and tanks as well, need to be concealed for short periods only. A plane on landing, for instance, may require over its regular finish a quick coat of paint, which can then readily be washed off with a garden hose spray of cheap solvents.

For the concealment of equipment, roads, bridges, installations, landing fields and buildings, the requirements call for a paint which can be applied easily, can be transported readily and can be thinned with water. Also, the material has to be fungus-proof, fade-proof and have good coverage. This combination of properties has been met by the paint manufacturers with emulsion paints.

Luminous paints are another wartime requirement. Of course, there are two main groups, the radio-active materials emitting short wave emanations through slowly disintegrating fluorescent, and phosphorescent pigments.

The fluorescent pigments are commonly used on the dials in the cockpit of a plane. They must be activated by ultra-violet or "black light," and are visible only when so activated. It is the "black light" which the pilot switches on and so renders the dial visible. It is immediately invisible when the "black light" is turned off.

Phosphorescent paints have found use on the subways, buildings and street curbings of "blackout" London. These paints will glow in the dark without fading for several hours, if they have previously been subjected to bright light for a short time. They are available in several colors. Activated strontium sulphide glows bluish-white and is the best and most popular. Activated zinc sulphide glows greenish-yellow; activated calcium sulphide produces a purple glow.

Various other types of blackout paints and lacquers have been used on the U. S. Atlantic seaboard to meet the dimout regulations which have prevailed there. These range from cheap water paints and cold cut asphaltums to expensive shatter-proof lacquers both pigmented and unpigmented, which are capable of preventing injury from breaking glass in case of bombing.

The Future of Organic Finishes

Without question, until the war is over, civilian use of finishing material will be progressively curtailed. After the war, organic finishes should find a rosy future. Household luxuries and equipment will have to be finished and decorated, perhaps in bright colors, or in the colors which are becoming so familiar today, the warm drabs, olive greens, blues and earth shades. Automobiles, refrigerators and home and office air-conditioning units will have to be finished. New plastic materials may pose new finishing problems, but organic coatings will be required for them.

Government Regulations

In general, WPB Conservation Orders covering metals were relaxed in 1944. The restrictions on copper, zinc and aluminum were substantially loosened and the uses of these metals permitted for a number of new products.

Cadmium, nickel and tin continue to be scarce and restrictions tight, although in a few particulars they have been liberalized to a small extent. Chromic acid and copper cyanide have become very scarce.

Silver plating restrictions under Order M-199 were changed in many ways and restrictions relaxed for small concerns.

Order L-110 limiting the purchase of electroplating equipment was discontinued and electroplating equipment was included under Order L-123. Purchases of such equipment up to $500 are still permissible without special application but simply under MRO certification with a blanket priority of AA1.

Plating equipment may now be ordered and delivered without application to the WPB if the equipment ordered is available in the district itself and if no rated orders are in the hands of the supplier, for the equipment ordered.

Transportation

(CONTINUED FROM PAGE 81)

field of jet propulsion early in 1944 were evidently an effort to minimize any propaganda value that Germany planned for the Me-262 and the jet-propelled pilotless plane, the V-1, as the plane announced was a fighter-type, but it was specified at the time that it was being built for training purposes. This was in contrast to previous policies of keeping new weapons concealed until they had been used in combat.

Millions in research are being spent to bring jet power into action against the Axis, and every fighter plane designer, and every aircraft engine designer is to some degree concerned with it. Every aircraft manufacturer is conducting research contemplating its use.

Still clothed with secrecy, it is known that Allison Division of General Motors is converting to engine production; General Electric, who pioneered the engine development in this country, is equipping an entire plant for engine production; Westinghouse is working on a new engine development for the Navy; Ryan has produced a combination jet and conventionally powered plane for the Navy, and Lockheed is expanding facilities for the production of a yet secret fighter.

The only plane described so far is conventional in every detail except that it uses the jet power. The units burn Kerosene, using a compressor fan, and turbine rotor mounted on a single rotating shaft. High fuel consumption is a bugaboo for aircraft, makes the fighters now in the public eye useful primarily as interceptors, where the range can be short.

Constant improvement is now being made in the fuel consumption rate and the aircraft industry is looking forward to the development of a combination jet and propeller system that will be as efficient at low altitudes as the jet is at extreme high altitudes. Some such system will be the important postwar commercial development, particularly in the field of long-range transport, and will almost certainly monopolize the military fighter plane field of the future.

In the development of a rocket-powered fighter plane, the Me-163, the Germans appear to have outstripped the Allies. Although possessing fuel for only 12 minutes of powered flight, this plane is described by American pilots as capable of phenomenal speed and rate of climb. It has an unusually low wing loading allowing it to glide freely with power off. Other than these fragments, little has been disclosed of the nature of this plane.

What effect gas turbines may have on other methods of transport is the subject of much scientific debate, and promises to be one of the fastest moving projects in the postwar world.

While the most important immediate postwar aviation sphere is in transport and possible military construction, the private plane field is being examined carefully by several firms. The standard types common before the war and in use in the war effort will doubtless emerge as slightly improved versions of their forbears. Some of the firms now producing combat craft have plans in this field, notably Republic with an amphibian announced during 1944.

While the immediate future of the private plane market is cloudy, most aviation enthusiasts feel that from five to ten years after the close of hostilities it will be a larger industry than the transport production. This is conditional on the development of safer private planes capable of higher cruising speeds than are current models, and some reduction in price.

The much heralded helicopter has gone through a development period during the past war in which the AAF has put hundreds of hours of operational time on existing models, used them on many beneficial missions of mercy, and trained a large staff of pilots and maintenance crews. Many of the major problems of helicopter design are being worked on, notably all types of vibration which have plagued all engineers in the field.

The postwar importance of the helicopter is dependent upon the solution of these major design problems, and the simplification of the art of helicopter flying. New entrants in the field in 1944 promise much toward the solutions, and years of developmental work may produce a new mode of transport of considerable importance. At least two major firms are now interesting themselves in the development of what is known as a "convert-o-plane," that is a craft retaining the ability of the helicopter to ascend and descend vertically, yet assuming the attitude of a conventional airplane in full flight. Known to be theoretically successful, such craft would surmount the maximum forward speed of the helicopter, which is relatively low, but would give the normal airplane the accessibility feature of the helicopter. These developments however, are far in the future.

Important as the aircraft industry will be in the postwar era, it will probably not revolutionize the transport field, but simply complement it, and specialize it further.

While the aircraft industry has gone into production of new models, the automotive industry has continued to add its production facilities to raise the war record to new highs.

In the automotive industry, production of aircraft, tanks, military vehicles, guns, marine equipment, ammunition, and other items needed by the Armed Forces achieved a rate in excess of ten billion dollars annually. This included an output of over $700,000,000 worth of essential replacement parts authorized by the government to maintain the country's passenger cars.

This production drive is the cooperative effort of over 500 large and small automotive manufacturers located in 31 states. Working with them is a nation-wide chain of sub-contractors located in 1375 cities in 44 states. Most of the latter are small businesses, 63 per cent employ less than 500 persons, yet often furnishing as much as 98 per cent of a finished product.

While all of this war activity was going on automobile men were thinking of the future of the time when there would once more be passenger cars to build. Probably the biggest item of interest to all is the pot of gold awaiting the manufacturer who fills the great backlog of passenger-car demand built up during war years. Obviously, no one company will get all of this business, but each is anxious to gain some slight edge on the market to enhance its profits.

Up to the present, government restrictions have prevented any kind of reconversion activities other than a very limited expenditure for design and experimental work. The industry, although anxious to continue war production as long as necessary, feels that it should be allowed more leeway for planning, and be furnished some machine tools and dies, to be prepared. This is all a part of a plan for partial reconversion of the industry desired by the companies after victory is won in Europe.

Such a plan, if agreed upon by all concerned, would permit production equal to about 50 per cent of pre-war capacity in a year's time. This would amount to about 2,000,000 cars to be

pro-rated among the various manufacturers. Detroit men feel that some plan will be approved during 1945 so that during the year passenger car production will get under way. Official "de-emphasis" of reconversion, plus revised estimates of the quantities of materiel needed for the war against Japan, however, prove Detroit opinion to be premature.

Regardless of when reconversion comes in Detroit, there is no doubt concerning the existence of a backlog market for new passenger cars. Although arriving at a precise figure on the size of the backlog is difficult, certain approximate figures can be used with a fair degree of safety. In 1941 there were 29,600,000 passenger car registrations in this country, and old cars were going off the road at a rate of approximately 12 per cent a year.

Thus in the normal course of events, in August of 1944 there would have been 22,000,000 cars remaining on the road, and this figure would diminish to 19,400,000 by next summer. The war has changed the basis of computation as owners are using their cars longer than normally so that, actually, the figure is not that low. It seems probable that the backlog will amount to about 9 milion cars by next summer.

Mindful of this backlog, the automobile industry is planning a postwar capacity of 6 million cars a year, 50 per cent increase over the pre-war peak year, 1929. If a partial reconversion year produces 2 million cars, auto men hope to reconvert fully the next year hitting 4 million cars. Even this rate will not start to cut down the backlog, but will only satisfy current needs.

Plans call for the production rate to go up to 5,250,000 cars during the second fully reconverted year, and to go on up to 6 milion for the next two to three years. This rate will satisfy the backlog, and when that is accomplished, it is presumed that production will taper off. With the probability of this tapering off in mind, Chevrolet has already announced its intention of working seven days a week, and three shift schedules rather than overexpanding plant facilities while in the boom years. This will probably be a general practice in the industry.

It is interesting that the automotive industry is taking this optimistic view of the postwar buying power of Americans, and their willingness to buy. If this presumption is incorrect, Detroit may never see a six million car year.

Much has been said during 1944 on just what the postwar car will be. In general, despite all statements to the contrary, it appears certain that the first models will approximate a "normal model change" compared to 1942 cars. The radical changes, if there are any, will follow later. There will be, however, some exceptions to this rule.

For example, while Ford's first product will follow the pattern of the 1942 line, he will go into a low-price car, about 15 per cent less than the price of low-price 1942 models. Bantam, Crosley and Austin also assert that they plan to build low price cars. The conscientious opinion among auto men is that these efforts to duplicate Ford's feat of 1921, when he caught the public fancy overwhelmingly with the Model T, will fail.

Graham has announced that its postwar car will be an entirely new car, but it, too, will follow the appearance of the first cars to reach the market. Willys is avowedly shooting for the mass market with commercialized version of the wartime jeep, but it appears doubtful if the jeep chassis, including the four-wheel drive, can be produced to sell in a highly competitive market. Surpluses from the war, at reduced prices, will doubtless find a ready market. As far as other radical changes in the automobile design are concerned, Detroit is taking an extremely conservative stand. They are, of course, investigating new ideas, and spending considerable sums on research. It must be remembered that volume production tends to create a conservative design. A major error on a model change might well ruin the year's market, and thus endanger the financial position of even the largest producer.

Considerable interest centers around the withdrawal in 1944 of the Fisher brothers from the General Motors organization, and their incorporation of two firms for the general purpose of building autos. Although they are not as yet doing so, opinion in the automobile center is that sooner or later they will be in the business. The only statement made by the brothers themselves to date is that they desired to protect the use of their name.

Although certain West Coast aircraft manufacturers have stated that they are considering postwar automobile production, economic factors will militate against them. Components are largely produced in the East and Midwest, and even were Western steel an encouragement, the project seems doubtful. Present efforts of the OPA are to convince auto builders that they should sell the first autos at 1941 price levels, but it appears that some price relief will be afforded. Trucks were recently repriced from 11 to 24 per cent higher on specific models, and similar increases are expected by passenger car producers.

As an adjunct to the operations of the Navy and the Army, the American Merchant Marine has proved to be as vital a link in our national security, one worthy of careful consideration in peacetime. The advent of World War I brought about a tremendous boom in shipbuilding, as it became necessary to carry the goods of war to Europe.

Unfortunately that fleet was not replenished after the end of the war, so that it all became obsolete at once, and then we were again largely without a merchant fleet. In 1936 Congress took cognizance of the importance of an adequate merchant marine, and passed the Merchant Marine Act, setting up the Maritime Commission to supervise the construction of such a fleet and to direct and control overseas shipping. Work got underway to provide designs for "utility" vessels capable of hauling passengers and cargo economically. Luxury passenger ships were specifically avoided, as being unsuited to all-purpose needs of this country. As a result of this program, by Jan. 1, 1942, the United States had a deadweight tonnage of 11,000,000.

The Maritime Commission building program was only getting underway when the country entered the war and the entire program was greatly expanded. At the end of 1944 the Merchant Marine had built a total of 4334 ships in the three previous years. This totalled 43,864,869 plus deadweight tons estimated production for the three years. Production dropped slightly in 1944 compared with 1943, from 1896 vessels to 1692 in the past year. According to the Commission this drop is due to the changeover of many large producing yards from the Liberty type cargo ship to the newer Victory type, and the construction of complicated combat vessels for the Navy in many of the yards. This construction program consumed approximately 5 million tons of steel plates in 1944.

Although no building program for 1945 past July 1 has yet been approved for the Commission, it seems certain that another substantial ship building program will be approved, as the war in the Pacific promises to require more than twice as many ships

as the transport of similar material to the United Kingdom.

This is due in part to the distance involved, 7000 miles to the Philippines, further to India, and only 3000 to England. In addition, port facilities in Britain are good, while in Asiatic waters they are limited at best, and promise to be practically demolished before they are captured. Lack of adequate unloading facilities ties up ships, and tied up ships means more ships required. Five million tons of merchant ships tied up in shuttle service increases the need for building.

In addition to the need for producing the ships for war, Admiral Emory S. Land, head of the Commission, is concerned with fulfilling the provisions of the Merchant Marine Act in the postwar period. It is a matter of record that the Admiral and the administration interpret the "substantial portion of the nation's water borne commerce" which is to be carried in American bottoms to be over 50 per cent of the total trade. The Admiral is extremely anxious that the ships be up to date, and as efficient as possible.

To accomplish the latter most of the war-produced ships will need to be replaced within a few years, as their design was frozen to expedite production in the yards. This situation was partially remedied in 1944, and doubtless further strides will be taken during 1945 to modernize designs and installations. The Liberty ship type, however, is definitely outclassed by the later types of cargo vessels. If Admiral Land's dream of a strong postwar merchant fleet is to come true, it must possess the best available ships, with advances in engineering and science applied as soon as they are proven.

In addition to the need for technically fine ships, the American Merchant Fleet will be plagued by competition from ships built in cheap labor markets, ships built of raw material produced in cheap labor areas, and manned by crews whose standard of living is much lower than that of American seamen.

If American goods are to be attracted to vessels of our own fleet, rates must match those of the competition. Thus, either we must lower the living standard of American labor advance so far in technical knowledge that we overcome this economic disadvantage, or subsidize the merchant fleet. Were it not for the military value of the fleet in wartime, the latter would not be likely. It is expected that some form of subsidy from the government plus maximum technological superiority will both be depended upon in the future.

With the Maritime Commission performing the procurement job for ships, the War Shipping Administration was established in 1942 to be the ship operating agency for the war emergency. Also under the guidance of Admiral Land, the WSA has performed the task of gathering the loose ends of shipping demands of a global war and tying them into as efficient as possible a system. Needs of convoy travel, absence of return loads, inadequate port facilities, shifting fortunes of war, constant needs of the military to be oversupplied rather than undersupplied combine to make wartime shipping a most uneconomical operation. Planning of operations, at best, is an effort to reduce the waste of shipping space as much as possible. To perform this task the WSA enlisted the aid, under contract, of more than 100 American flag lines. They hired the men, fueled the ships and have kept the fleet running since Pearl Harbor.

In the design of ships emphasis has been placed on the construction of turbine power units for both the Navy's ships and the merchant vessels. On the new Victory Ship model put in production a 6000 hp. unit is standard for all vessels built in any yard. This ship is built as a speedier successor to the Liberty model for higher speeds and a cruising radius increase from 9000 miles for its predecessor to 20,500 miles.

War accelerated engineering advances bring the future of the gas turbine into the forefront in the marine field, as well as in aircraft and rail travel. Several designs of 3000 hp. size for marine application have been studied, and experimental units are probably under construction. They embody the usual advantages of such a unit, compactness, simplicity, light weight, and absence of auxiliaries. Being a space saver, simple to operate and with probable advantage of low maintenance, studies indicate that it may be possible to double the power of some vessels by replacing present power systems with gas turbines.

Ferrous Metallurgy

(CONTINUED FROM PAGE 71)

sheet and strip mill capacity of the steel industry was converted, early in the war, to the making of plates, thus helping to cope with the huge demand which developed for this type of product. These activities are still continuing on a large scale and it is generally conceded that these converted mills made a most vital contribution to the war effort. Such sheet and strip mill products as have been produced during the war period have served to increase the fund of technical knowledge on such subjects as deep drawing, forming, welding and other methods of fabrication of light-gage steel. All of this newly acquired information will be applicable to a wide variety of peacetime products when the time for the manufacture of such items once again arrives.

The tin plate mills have, of course, been busy throughout the whole emergency, their main problem having been to stretch the meager supplies of tin to the utmost. Further improvement of equipment for the electrolytic coating of strip continuously with tin, zinc or other metals has brought the technology to a high state of development and many electrolytic lines are now in successful operation turning out satisfactory product at rates that were undreamed of a few years ago.

The so-called low-alloy high-strength steels which came in for so much attention before the war have undergone something of a temporary eclipse because of the scarcity of the necessary alloying elements. Development work has continued, however, and there is definite evidence of a resurgence of interest in these materials as war restrictions are lifted. The outstanding feature of these steels, which combine high strength and corrosion resistance, is the fact that they lend themselves to designs by which a substantial percentage of dead weight can be eliminated. Railroads, trucks, buses, ships, in fact all forms of public or private transportation are logical beneficiaries of this particular development. This should have an especially strong appeal to manufacturers, operators and the consuming public which have been made acutely conscious of the importance of weight-saving in this war.

In a somewhat different, but nevertheless indirectly related, field of steel

construction is the attention and study which have been given to the wider use of relatively light-gage sheet or strip steel fabricated into sections and sub-assemblies for a wide variety of structural purposes. Considerable experience has been gained in this field, during the war period, on such typical military items as barracks, warehouses, hangars, shops, huts, etc. Many of these items were designed, to a large extent, as pre-fabricated structures, the units of which could be easily transported to the site and erected there quickly with a minimum of labor. Such structures, conceivably, could be knocked down and re-located on short notice, should the circumstances demand it. Much of this experience, together with the improved techniques and methods of assembly evolved, should be applicable to the problems of postwar pre-fabricated housing and similar construction, concerning which there has been much discussion in recent months. The advantages of these light-weight constructions have been amply demonstrated and in fact they hardly require demonstration to establish their merits. However, many of the practical aspects of the problem, particularly those of getting the industry established on a mass-production basis, are capable of further development and perfection. That this will be achieved in due course there seems little doubt.

Miscellaneous Items

The list of processes and products on which recognizable improvement or notable accomplishment has been achieved in the last year could be expanded almost indefinitely. The following may be mentioned, in passing, merely as typical examples which have come within this reviewer's field of observation.

Many wire products, specifically designed for war purposes and involving special drafting, processing, heat treatment or fabrication have fulfilled their particular purposes with outstanding success. The development of drawn rod or wire for bullet cores is an example of industry effort which has received little publicity, but is generally conceded by those who know, to have been a significant contribution to the war effort. Many special types of springs, and flat wire products such as machine-gun belt links, have also played their highly specialized part in military and naval applications. All of these products required special development or investigative work before they could be put into quantity production, and the quantities required almost defy comprehension.

The steel casings industry has successfully met the demands of war in producing new products in the form of various heavy and intricate castings for military purposes. Much of this effort required development of new plant, new methods and new techniques, including the evolution of new steel compositions and fancy heat treating processes on a scale never before attempted by this industry. Centrifugal casting has been the subject of continued intensive investigation and development on many new types of product, with results that are encouraging, although much remains to be done.

Powder metallurgy, while not exclusively concerned with ferrous powders, has continued to make significant progress and a wide variety of products are now being produced by powder metallurgy methods at what is claimed to be considerable savings in cost and material as compared to what can be accomplished by the more conventional methods of manufacture.

Mention might also be made of the continued refinement and wider application of purely investigational and inspection technique, which constitutes a form of sustained effort that goes on year after year without much fanfare of trumpets or beating of drums. Subjects that come to mind are improvements in metallographic practices, increased use of statistical methods on inspection problems, wider use of the electron microscope and diffraction apparatus, increased employment of the spectrograph in steel mill analytical control work, refinements in such diverse fields as micro-hardness testing, magnetic inspection, X-Ray, and radiographic inspection, thermo-electric identification and sorting apparatus and many others too numerous to list here. The tangible evidence of progress in many of these subjects may be hardly detectable in any given year, but the net effect over a period of years is significant, since the result is always in the direction of developing more powerful tools for the unearthing of useful metallurgical knowledge.

All of the above, plus much more that has been left unsaid, adds up to a rather satisfying picture of ferrous metallurgical progress in the year just past, although care should be taken not to feel smug about it. Moreover, this advancement in many diverse fields has come about in spite of the fact that the country is still involved in a national emergency, with all that that implies in the way of urgent pressure for steel production and war-time restrictions on man-power, materials and equipment. That much of this technological progress will carry over and be capitalized in peace-time benefits is beyond the shadow of a doubt.

Non-Ferrous Metallurgy

(CONTINUED FROM PAGE 75)

tance, condenser tubes of such material offer considerable promise.

Developments in Casting

Great interest is shown in continuous casting processes. American Smelting & Refining Co. and Alcoa have been successfully using continuous casting copper and aluminum alloy billets, respectively, at speeds of about 10 in. per min. One of the late installations for aluminum uses a boot at the bottom of the mold to force cooling water in the annual space between the shrinking billet and the mold wall.

Plaster mold castings are being used increasingly, principally for yellow brass, but also for aluminum bronze, manganese bronze, and aluminum alloys. The presence of aluminum in the alloy composition or from a mold spray of aluminum powder has been found helpful in producing good castings by this method. Parts with dimensions accurate to ± 0.005 in. can be cast with dimensional accuracy and surface only slightly inferior to those obtained with die castings and permanent mold castings. Large castings, such as airplane engine parts and tire molds can be cast in this manner, although tolerances may vary with size of casting.

Much experimental work has been done to improve precision investment casting methods. The essentials of the process consist of the production of a split master metal mold made from a replica of the desired casting. Wax castings are made in this mold, placed in a flask, and investment material poured around them. The wax is melted out and the actual casting is usually made centrifugally or under pressure. Woods metal cast under

pressure is most used in the production of the metal mold. There is much secrecy on the specific waxes and procedures used for the other operations, however, and considerable difficulty is often encountered in specific applications of the method. This procedure is only applicable to comparatively small castings.

Surfacing

Lead-coated steel continues to be produced satisfactorily, although the tendency has been to make very thin coatings on strip and sheet. Increasing the antimony content from the present 2 per cent to around 10 per cent seems to be greatly beneficial in giving increased corrosion resistance as well as greater hardness, smoothness, and general appearance. Much of the long terne metal now used contains only 10 per cent tin, but production proceeds reasonably satisfactorily.

Aluminum coated steel in sheet or strip form has been developed technically and has been produced on a limited scale. It is expected that with release of aluminum for miscellaneous purposes this product will be available again. Clad metals of all sorts from copper, brass, nickel, and stainless steel to platinum continue to find new applications and advantages in saving expensive metals. The technology, as well as market, is now well established.

Machine Tools

(CONTINUED FROM PAGE 89)

per cent of its original selling price. If the tool is 3½ or four years old, it does not depreciate further. Whether this regulation will be continued with the new three-man board, not yet fully set up, remains to be seen.

No government-owned plants under private management have been sold as yet, although several have been under negotiation. Every plant in the country in which the DPC owns a substantial interest has been given an advance listing as being "available," much to the consternation of the present operators who at first thought this agency was going to sell the plants out from under them immediately. Rather it was the intention of the RFC to undertake negotiations with the lessees in possession and with other interested parties relative to the disposal of the plants, subject to their continuing in war production, just as certain individual machine tools are being sold to lessees in possession subject to the condition that the tools be kept on war work as long as may be necessary.

The tools the Army has declared surplus are tools that the Ordnance Department bought second hand at the beginning of the war. Some of them date back as far as 1890 to 1900. These tools have been auctioned off in a few instances. One sale of such machines recently brought $35,000 for the lot at Watervliet Arsenal, indicating that some one must see some value in them. Naturally, the machine tool industry would like to see this ancient equipment broken up for the cupola. Like the proverbial cat, machine tools apparently have nine lives.

It is interesting to note how the attitude of the machine tool industry toward disposal of surpluses has changed during the year. At the spring meeting of the National Machine Tool Builders Association, foreign markets were envisioned as the best possible outlets for our surplus equipment. The Russians would buy them and industrially undeveloped countries like South America, India, China, would open up vast markets for these machines. Meanwhile brand new tools would be developed for the home market. So the argument ran.

By fall, the viewpoint had changed. The Russians wanted new machines and according to past performances frequently wanted bigger machines than had ever been requisitioned by our own manufacturers. Fearing that surplus machines might hang over the market and act as a brake on new sales, leaders in the industry urged that the machine tool builders use every effort to bring surplus machine tools on the market and get them operating in the postwar economy. By this time the problem of disposal of surplus machines was seen to lie not in foreign markets but here at home. American factories need these modern machines to provide high level employment and low cost production. The same sentiments were echoed in Washington. The more plants that use latest and best tools, the more new tools they buy and the more likely are they to scrap obsolete equipment. Incidentally, it is these older tools that have suffered from a 24-hr.-a-day, seven-day week service in war work at the hands of unskilled operators. There is no question, however, that the builders of standard machine tools are going to have a headache in the next two or three years as regards surpluses. About the only thing they can do is sweat it out until the surpluses are disposed of.

Basically, the price policy on surplus machine tools is such as to prevent dumping and to discourage speculators buying up large lots of tools at bargain prices. Under the present OPA ceilings on second hand machines it is possible for machines in some age categories to be bought up at prices under the Clayton formula and resold at a nice profit, but in many cases the reverse is true. Recent auction sales of large lots of machines has tended to upset this picture and allow the speculators to enter the market, but in general such sales have been confined to the older types of second-hand machines which were pressed into service in the early stages of the small arms programs. On the other hand, many of these machines have limited application in peacetime work. For the newer machines the depreciation formula is such as not to encourage lessees or other buyers from delaying buying action until the last minute in order to obtain a more advantageous price.

Much criticism has been directed at the surplus property bill now on the law books. No one in the industry views with favor the setup of a three-man board and there have been no cheers for the two men named to head the triumvirate thus far. Particularly is it feared that priorities established for tax supported institutions or political instruments will delay disposal of surplus machinery. Where the sale of a plant or block of machinery runs over $1 million the Attorney General is given 90 days in which to render an opinion regarding the validity of the sale under the law and Congress itself is given 30 days in which to turn down or give silent assent to sales agreements involving over $5 million. The effect of such delays on plant negotiations can well be imagined. Otherwise the provisions of the law and the present policy of the DPC closely parallel the recommendations of the NMTBA.

Spokesmen feel that in taxation, in renegotiation and in manpower problems, the machine tool industry is not getting the consideration to which it is entitled as one of the most basic industries of the country. As the

(CONTINUED ON PAGE 193)

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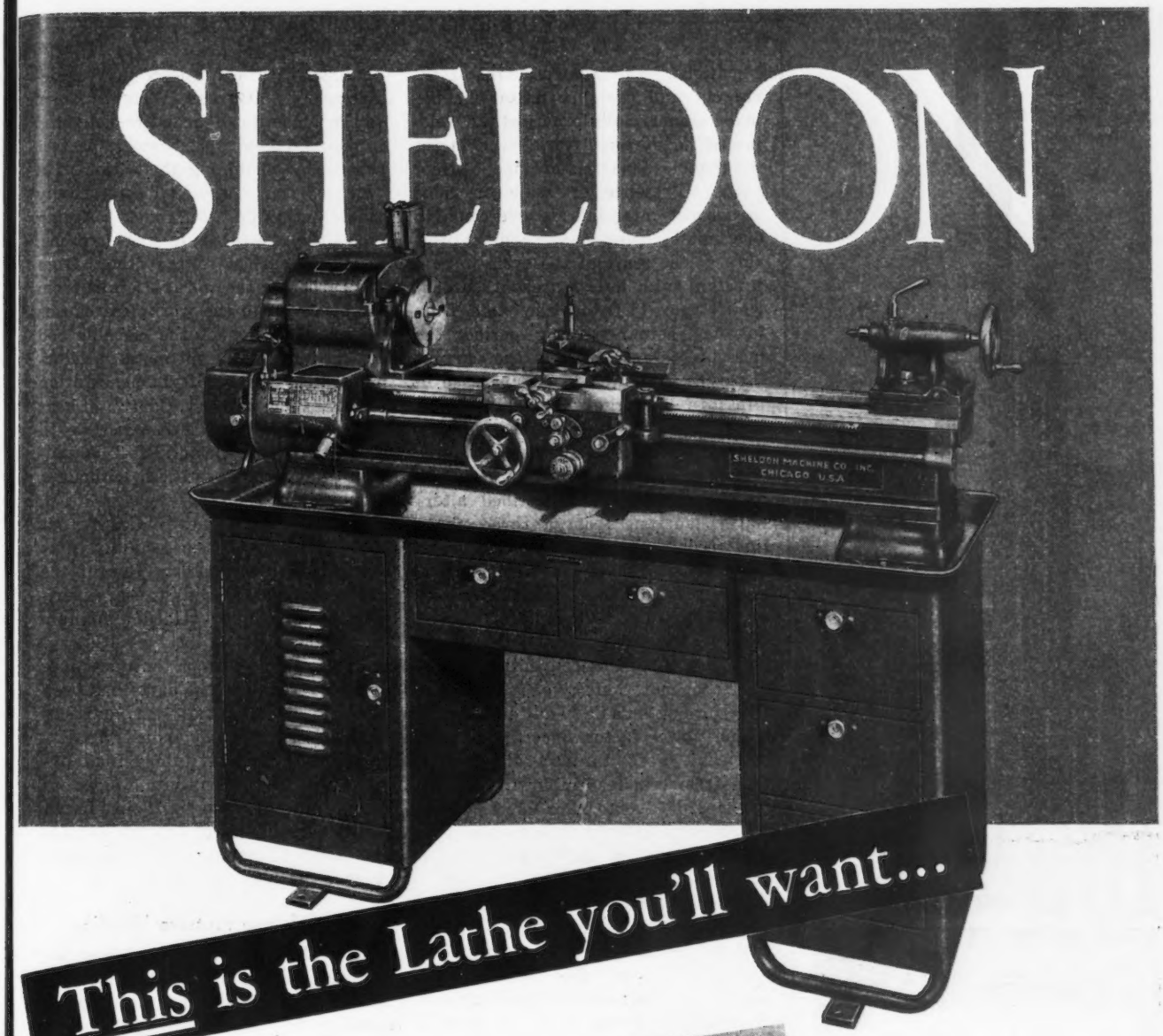

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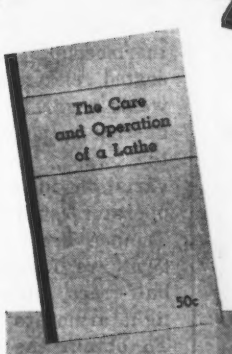

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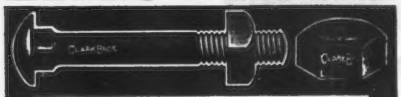

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plications. Electronic control of the current and pressure pulsations has made commercially practical the welding of heavy gage work, even in the hardenable materials like armor plate. Presence of scale on most structural materials is overcome in one unit by using a high contact pressure at the start of the cycle in conjunction with a low preheat current which tends to reduce the oxide. During the actual welding period, the pressure is reduced and the current increased, followed by an increase in pressure to forge the weld nugget. Post heating and controlled quenching then follows in the case of hardenable steels.

One unit, drawing rectified alternating current from a three phase line feeds a shot of direct current to split coils of the transformer primary, giving 6 to 20 cycles per sec. of reversed direct current for a matter of several seconds. Advantages claimed for this unconventional system are more effective use of the transformer material and hence higher power factor since the current and flux goes through the entire transformer instead of flowing around the outside due to skin effect, which occurs even with 60 cycle current. A balanced load on the feeder lines is another advantage cited.

Another interesting development along this line is an automatic cycle spot welder in which the heat treating cycle is controlled by the temperature of the material itself instead of using preset time cycles. Use of a thermocouple built into a refrigerated electrode produces identical welds regardless of variations in induction losses due to the position of the work, short circuiting effect, variation in surface conditions and operator skill. In one plant, 38 Temp-A-Trol forge welders of this type are fabricating components of half-tracs, including the welding of light armor to mild steel structures. To obtain the same output by arc welding, 200 operators would have had to be trained for this work. The complete cycle consists of the actual welding current, a second shot to refine the grain by bringing the metal past the critical point and a third shot for tempering the nugget followed by controlled cooling. The corresponding pressure cycle is in the descending order of magnitude.

Multi-Arc Welding

Clean dense welds in heat treated aluminum alloys like 24S-T, heretofore difficult to weld, are now being obtained with a multi-arc process developed by Curtiss-Wright Corp. Large amounts of heat are delivered in concentrated form under perfect control by combining the action of a twin carbon torch and a heavily coated metallic electrode. Arcing from the electrode to the carbons, from one carbon to the other, from one carbon to the workpiece and from the electrode to the workpiece causes immediate fusion of the metallic rod deposit and the parent metal, producing a weld with uniform penetration and free from pososity. Control of heat is such that it has been possible to weld 0.016 in. Alclad 24S-T aluminum alloy by this process without a backup strip.

Recent experiments indicate that aluminum may be successfully slow butt welded electrically. One of the tire companies is said to be experimenting with butt welded aluminum wheel rims.

Application of flash butt welding to high strength steel parts has been extended in the past year, particularly in the aircraft industry. Experimentally at least tubing for landing struts has been butt welded to forgings in sizes up to 16 in., but a small percentage of inconsistencies (1-2 per cent) makes proof testing of every assembly necessary.

Oxyacetylene Pressure Welding

Solid phase welding was a term introduced last year to describe the method of joining two structural members in which none of the material is melted at any time during the welding process. A recently developed practical application of this process is oxyacetylene pressure welding in which the members are bonded by atomic forces without the presence of a liquid phase at any stage. In pressure welding a multi-flame oxyacetylene heating head shaped to conform to the shape of the members being welded is used to heat the abutting ends to a temperature between 1925 and 2200 deg. F. and then pressure is applied in the range of 2500 to 4000 lb. per sq. in. The pressure produces an upset of smooth contour at the joint.

This method has been applied to the butt joining of rails, oil pipe lines up to 24 in. diameter, joining of tubing and forming of pressure vessels. Generally speaking, the total gas consumption during pressure welding is considerably less than that required for fusion welding because the time is shorter, being of the order of 1 min. per ¼ in. thickness.

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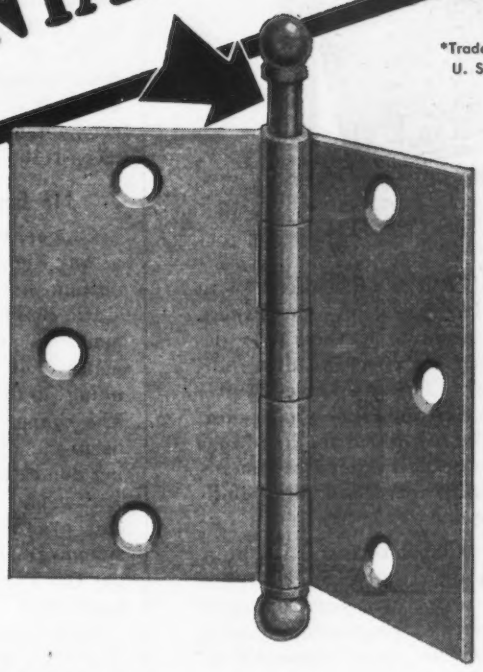

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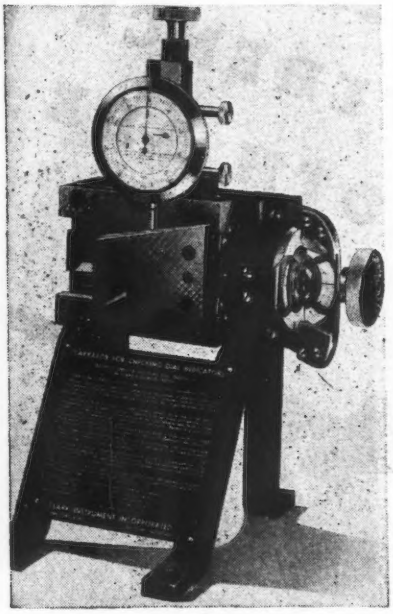

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Non-Ferrous Metals

(CONTINUED FROM PAGE 67)

miffed because some of the more aggressive sections of the business press, tired of vague handouts, rounded up figures on government held stocks of minerals and metals in mid-year, the Bureau of the Census clamped down further publicity. Asked the reason, one official quipped "There is no reason. It is simply a matter of policy."

From figures and ciphers gathered here and there, however, it is safe to estimate that aluminum stocks held by Metals Reserve Co. total in the region of 500,000,000 lb., leaving out of consideration metal still in the hands of DPC. A good part of this results from a Canadian purchase contract, on which further deliveries were deferred in April, probably forever. It is safe to estimate that government held magnesium stocks have passed 100,000,000 lb.

No Ecstasy for Red Queen

Copper, though every inch as much a war metal as aluminum and magnesium, never soared to the same ecstatic heights of speculative requirements in proportion to capacity, and hence was spared the swift sharp plunge into the cold bath of surplus. The copper story during the war has been one of gutting the few remaining domestic deposits, stepping up operations at low grade "rock farms," and, over the protests of operators of submarginal deposits, buying throughout the world wherever and whenever possible.

Cornelius F. Kelley, chairman of Anaconda, summed up the production side in February when he said "We can no longer look upon American mines as an inexhaustible treasure house. Our deposits of copper, lead and zinc have been and are being impaired to the point where national security demands they be carefully husbanded. . . . No new mine of importance has been discovered during the war. . . . Upon this hemisphere two great mines' output exceed world production of 40 years ago. For 1943 two American mining organizations produced for war more than the entire world output in any year prior to World War I."

Domestic mine production, except for a short spurt in March, drifted slowly, steadily downward so that preliminary October figures showed a production of 73,546 short tons compared to 88,546 short tons in January. The trend line coincides almost exactly with mine employment for of the 30,600 men on the payroll in January only 23,800 remained in August, and still less at the end of the year. War Manpower Commission's Paul McNutt pleaded, and sundry public and private officials issued dire warnings, but the exodus was unchecked. To top things off, the Army, which had released 3200 men to the mines in 1943 and 2300 in 1942 turned Indian giver, withdrawing soldiers in the younger age groups to correspond with its civilian draft policy. The year's mine output appears to be in the neighborhood of 975,000 net tons, more than 15,000 tons below 1943, more than 110,000 tons below 1942.

The Army's attitude was the tip-off on the supply-demand situation, for it was clear that if supply was drifting downwards, demand was too. Labor shortage hit the smelters, brass mills and foundries the same hard blows it hit the mines, thus reducing their capacity to absorb raw metal. Although a return to brass shell cases from steel was effected late in 1943 after brass capacities had been materially increased, cutbacks in small arms ammunition allowed sufficient metal. By March, metal production exceeded consumption by 5 per cent. In April the copper use order, M-9-c, was amended so that odds and ends of relatively essential items could be made of copper alloys when their use would save labor and facilitate production.

In May, 1944, supply of refined copper for the year was estimated at 1,750,000 tons indicating surplus of 22,000 tons. Then came a sharp sinking spell, inducing some gloom, but by December the original supply estimate looked about 25,000 tons low, and demand, despite increasing requirements for the shell program, appeared to be comfortably behind supply.

In addition, estimated scrap receipts for the year of about 1,375,000 tons flowed to industry supported by a firm price structure. The ratio of scrap receipts to domestic mine production was in the neighborhood of approximately 140 per cent, closely resembling the relationship which prevailed in the depression years of 1932 to 1935.

Public Peep Show

Giving the public a peep show, before being raided by the Bureau of the Census, WPB announced government held stocks of refined copper at 303,500 tons as of August 31. With industry stocks and material in proc-

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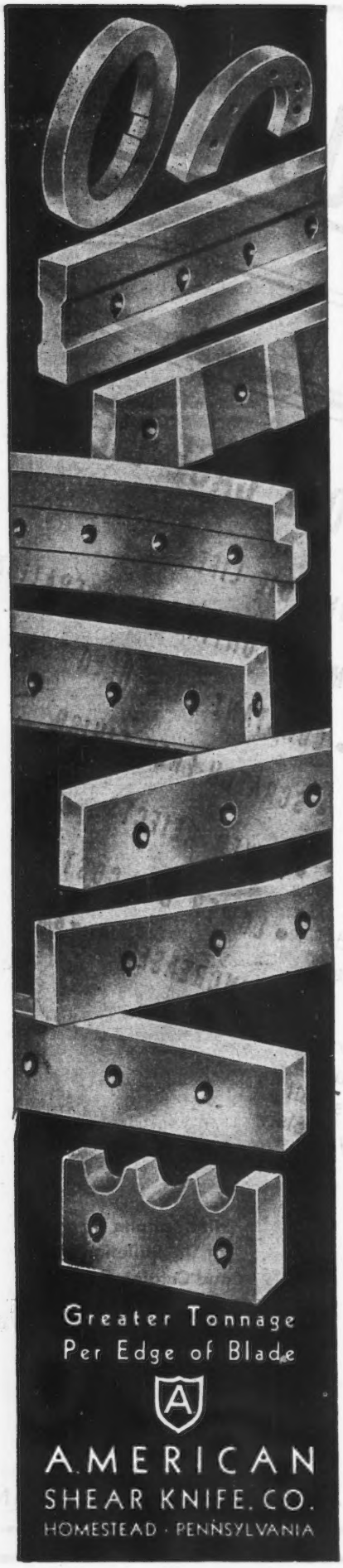

ess, the total was 467,000 tons. Today, despite inroads from the revived ordnance programs, stocks undoubtedly are comfortably over 500,000 tons.

Copper requirements for the heavy artillery ammunition program, upon which current emphasis is being placed, is chiefly for shell bands. Brass cartridge cases are not required for heavier shells, the charge being breach loaded. At the other end of the scale, small arms ammunition is a consumer of brass for cartridge cases, but unless the program grows to dimensions not now scheduled, will by no means drain stocks to the danger point. (Guesstimated additional 1945 copper requirements: 9000 tons monthly.) The rub will come in brass strip mills whose production dropped sharply in 1944. Of the 62,000 additional workers required for the ammunition program, the strip mills need 15,000, according to WPB.

Refined copper supply, however, will be bolstered commencing in February, 1945, by Canadian production, which until that time goes to Britain. Similarly, when British copper purchases from northern Rhodesia were reduced early in 1944, the supply was made available to the United States and Russia.

During the wave of early fall optimism for a rapid German defeat, WPB rough-sketched its ideas as to the probable industry pattern after V-E day. Refined copper requirements should be approximately 379,000 tons per quarter, approximately on a par with the third quarter of 1944. Military and essential civilian uses should consume 281,000 tons and civilian uses 98,000 tons, it was indicated. Wire mill production was expected to increase, brass mill production to drop. Soon it was expected that private and public utilities would demand products that would bring civilian goods production, employing copper materials, up to the 1941 peak. That was, of course, before the Army said it had changed its mind about cutbacks. Although the reconversion preview was discussed, the industry made no false starts under spot authorizations. For the fourth quarter, so-called Z (civilian) allotments, later to become as worthless as confederate currency, amounted to only 369,206 lb. of brass mill products, 53,685 lb. from the wire mills, and 306,228 lb. from the foundries—a mere drop in the bucket.

Like most other industries, domestic copper producers have been worried that stockpiles and production capacity built up during the war would co stitute a postwar threat. Reassuran on the stockpile matter for all no ferrous metal producers came throu passage of the Surplus Property A which provided for continuation emergency stockpiles of strategic a critical materials as insurance *again war and essential civilian* (*or w supporting*) *demand.* General WP policy has been to hold in reser amounts to equal to six months' r quirements of those materials whi must be imported and three month requirements of domestically produc material. In addition the act provid for holding sufficient material to ta care of any deficiency of supply und requirements for *non-war productio* for a six months period. Finally, t Army and Navy munitions board directed to freeze into a permane defense stockpile such amounts they believe would be required as w insurance.

Stockpile Menace Frozen

Philip D. Wilson, WPB vice-chai man for metals and minerals, summe up industry's relief on the matter b declaring "judging from the previe I have had of the Army and Nav thinking on the subject of defens stockpiles, I should say that the me ace to the market of material left u frozen by the services, if their pr gram is approved, will be unimpo tant."

As for postwar overproduction, Wi son declares that domestic econom may absorb 1,000,000 tons of copp and 700,000 to 900,000 tons each lead and zinc annually. Our unsubs dized domestic mine production toda represents only three fourths of th amount of copper, 60 per cent of lea and 40 per cent of zinc.

Government minerals productio subsidies under the Premium Pric Plan came in for some political snip ing during the year, but the Plan wa shielded by figures showing saving effected by the government over th prices which the country would hav had to pay for copper, lead and zin had the scheme not been in effect. I February it was estimated that th plan had saved $885,000,000 sinc Pearl Harbor, and additional saving since that time probably bring th figure over $1,000,000,000. Althoug some domestic copper mines receiv as much as 26½c. per lb. under th Plan, the overall average cost fo domestic production was about 13 per lb., compared to a ceiling of 12 The average lead cost has been 8 per lb. and zinc, 11 c. per lb., com

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pared to respective ceilings of 6.50c. and 8.25c.

The Premium Price Plan authorizes a joint WPB-OPA board to set up individual quotas for mines representing average production rates under normal conditions. Premiums are paid for new production, whether from newly opened mines or from marginal ore bodies in previously operating ones. As inaugurated in 1942 the Plan provided that basic quotas would not be cancellable before July 31, 1945, unless the national emergency ended before that time. Later when higher premiums were instituted to give necessary relief to higher cost mines and to stimulate greater production, the right to cancel these additional premiums upon 30 days' notice was reserved. When the copper situation became easier, and zinc production far outstripped consumption, uneasiness developed. By last fall it was freely rumored that the higher zinc premiums would be cancelled soon. Closer investigation of this possibility, however, revealed a peculiar situation concerning the relation of the country's zinc production to 1944's war Cinderella, lead.

Like paper and lumber, lead, at the outset of the war, seemed so abundant that it was freely recommended as a substitute for other metals which had been called to the colors with much fanfare and waving of flags. A 4-F of the metal kingdom, it won little heed from the bureaucratic glamorpusses pacing like pigeons to spur new production achievements from such war heroes as aluminum and magnesium and even zinc and copper.

Poor Siamese Twin

In 1943, while artificial respiration in the form of premium payments was used to revive such decadent zinc mines, lead won only corollary attention because it usually occurred in zinc bearing ores. Toward the end of the year it became apparent that the lead stockpile was slowly but surely being eaten away. Consumption for the year exceeded production by 60,000 tons.

In 1944 the pining patient sickened further. Domestic mine production dropped from 38,000 tons a month in January to 30,000 in October. The year's production appeared to be about 405,000 tons. As with all other western mines the lead camps and smelters lacked labor. From 18,700 men in lead-zinc mines in January, employment had dropped to 15,400 in August.

The crisis, though, came not from domestic labor but through Mexican. Because of strikes, hardly a ton was produced in Mexico during the month of June, virtually shutting off one of our most important foreign sources. Bottoms were scarce from Peru which, in 1943, had produced 43,500 net tons. Canadian mines, beset with the same labor difficulties as their American neighbors produced only about 9500 tons in September compared to a peak of 23,750 in May, 1942. Withdrawals from the Metals Reserve Co. stockpile by October had reduced the pile to around 120,000 tons from its peak of 275,000.

The final blow was revival of the small arms ammunition program, which in its heyday was one of the biggest consumers. WPB officially admitted in December that allocation of lead was a possibility, but trade circles regarded it as a certainty. Report has it that refined lead producers will be required to set aside a proportion of their stock, probably 20 per cent, to fill essential orders, although it still is a possibility when final requirements are in, that the entire output will be allocated.

A sizable proportion of the lead consumed other than for pigments, ammunition, and tetraethyl lead fluid is returned for use through scrap collectors and secondary smelters. Over half of lead scrap is in the form of battery plates. In 1943, 341,243 short tons of secondary lead was recovered in the United States compared to a total of 449,841 from primary sources, according to U. S. Bureau of Mines. Secondary recovery was only about 285,000 tons in 1944, while primary sources contributed slightly more than in 1943. Again, labor shortage was the restraining factor, plus the fact that increasing quantities of fabricated lead products were leaving the country, never to return.

Driving the lead-zinc automobile in 1944 was a matter of stepping on the lead accelerator at the same time as slamming on the zinc brakes.

A basic factor in the zinc shortage of 1942 and early 1943 was export requirements. In 1944, exports requirements were estimated to be only about 25 per cent of 1942 and 34 per cent of 1943.

Domestic slab zinc consumption was somewhat higher than in 1943, when 816,777 tons were required. In 1944, slab zinc production was about 897,000 tons, including domestic production from foreign ores, compared to 971,873 tons in 1943, according to American Zinc Institute.

If export requirements were promi-

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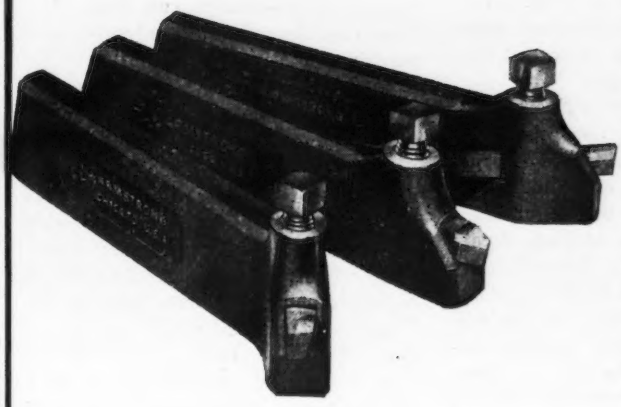

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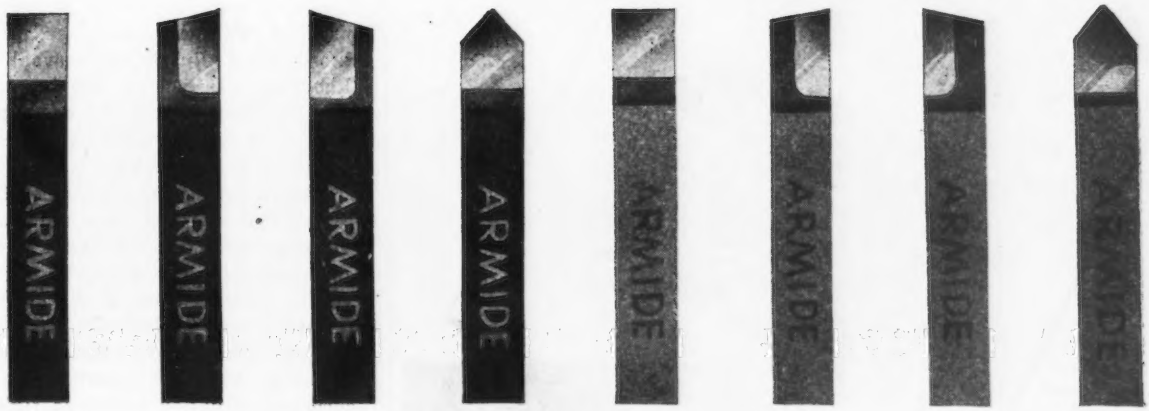

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nent in the early war calculations, imports forced their way into greater prominence as bottoms became available from South America and Australia. During 1942, Australian and South American mines had continued operations, stockpiling their concentrates because vessels were not available. In 1943 nearly 23 per cent of the total imports of zinc concentrates came from stockpiles and 77 per cent from current mine operation. In 1944, the stockpiles were nearly cleaned up, and 90 per cent of imports came from current operations. The great problem in 1944 was to shut off imports as expeditiously as possible, shaving the 1943 all time high when imports of zinc concentrates and refined metal exceeded 500,000 tons. Exchange agreements by which the United States imported from Canada high grade zinc in exchange for which we furnished it and the United Kingdom an equivalent amount of Prime Western were cancelled. Metals Reserve Co. contracts with four Canadian producers were terminated. Both actions took place in the spring of the year. Mexican production declined due to labor difficulties, unwittingly adding to solution of the problem.

Despite these deflationary tactics, supply continued to outstrip consumption, and it was estimated that the surplus for the year would amount to about 72,000 tons, which added to the 173,510 tons at the beginning of the year would place stocks, mostly government owned, at primary plants, at approximately 246,000 tons at the beginning of 1945.

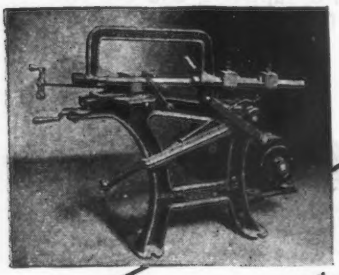
Brass requirements for the revived small arms ammunition program, which became apparent at the end of the year, were placed at approximately 6000 tons of high grade zinc monthly, amounting to about one sixth of current consumption of regular high grade and special high grade combined. The rub, it appeared, would be in the brass strip mills, severely beset by labor shortages.

Because most of the zinc being used for war purposes is non-returnable, except for amounts contained in brass scrap, the secondary zinc problem both during and after the war is of much less import than that of lead. Secondary zinc recovered in 1943 probably was closer to the 1942 total of 330,526 tons than the 1943 figure of 368,488. Consumers' scrap stocks exceeded 44,000 tons in October for the first time on record in the Bureau of Mines survey. This compares with estimated domestic mine production for the year of about 770,000 tons.

If the war has served to underline the dependence upon Western Hemisphere countries for such metals as zinc, for chrome and manganese it has shown definitely that U. S. sources lie over the ocean. Tempering this unwelcome discovery is the revelation that tungsten, which prewar largely was imported from China, can be secured in more than adequate quantities from western mines, that our molybdenum supplies within easy procurement range, are ample, and that Canada's nickel deposits can feed, with some exertion, even a carnivorous war machine.

After two years of gopher holing, with government assistance of various sorts, far western chrome miners generally failed to produce a product readily acceptable to industry. With the exception of mines still shipping in truckload lots to government stockpiles, which carried a strong political aroma, domestic chrome mining was virtually at a standstill at the end of 1944. Effective Jan. 1, 1945 Metals Reserve Co. gathered courage to boost the minimum chromic oxide content of ore which it would accept from 35 per cent to 42 per cent and the chrome-iron ratio from 1.5 to 1 to 2.0 to 1. Aside from low chrome content and a high percentage of insolubles in most domestic ores, the chief industry objection was based on the fact that they were fine rather than in desired lump form. From the standpoint of resources, however, the news of the year was resumption of Turkish shipments on a modest scale. But the big problem with these ores, as well as those from Russia, Transvaal and Rhodesia, was lack of shipping space. In Northern Rhodesia competition with copper for limited rail facilities added to the difficulty.

From a consumption standpoint, the big shift of the year was reflected in the skyrocketing demands for chrome chemicals, of which nearly 90 per cent go for military use. Transvaal ores, formerly used exclusively, were augmented with the better Russian ore in an effort to meet demand, but the chromate situation remained tight at the end of the year. For the fourth quarter, chrome military requirements were the largest in a considerable time, and their nature, according to WPB, precluded any appreciable relaxation even after the end of the European war. On the other hand, overall requirements, it is believed,



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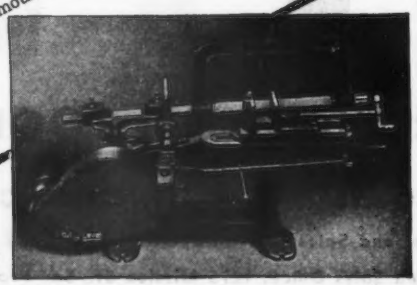

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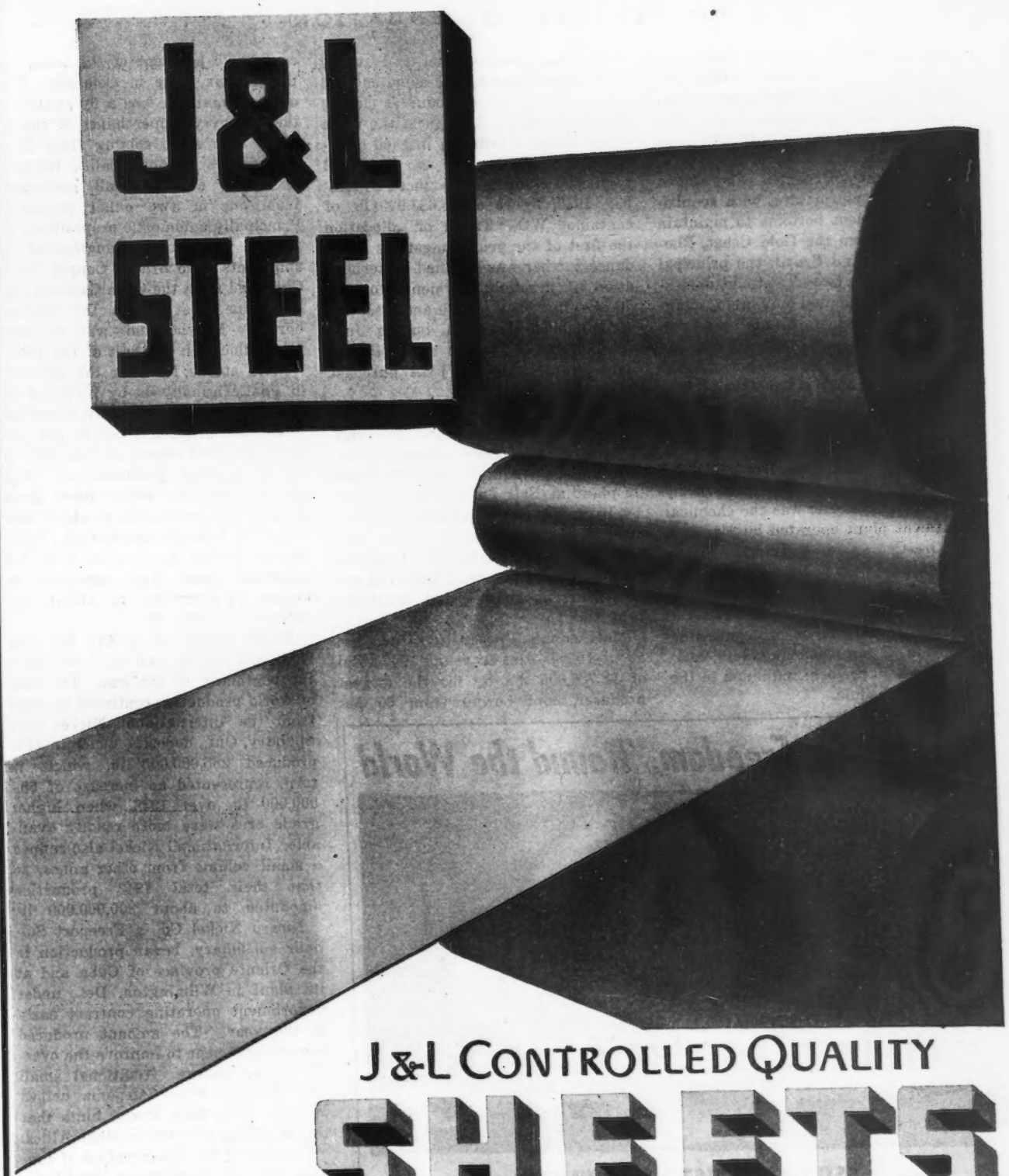

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remained below wartime peaks and there was little indication that this would increase. Government stocks, it is estimated, remained in the general neighborhood of 1,100,000 tons accumulated at the end of 1943.

Manganese presented an almost identical supply picture, with acquisition of sufficient bottoms to maintain shipments from the Gold Coast, Rhodesia, Cuba, and Brazil, the principal problem. With two exceptions, domestic mines contributed only minor quantities. Anaconda's Emma mine in Montana, a rhodochrosite deposit, for which a calcining plant was completed in 1943, produced a substantial tonnage. On the Olympic Peninsula in Washington, Sunshine Mining Co. contributed steady production from a deposit of hausmanite, one of the rarer manganese ores. Crossed off by WPB as uneconomic was the chemical treatment plant operated by Manganese Ore Co., an M. A. Hanna subsidiary, at Las Vegas, Nev. Smaller domestic producers were notified that after Jan. 1, 1945, the Metals Reserve Co. would purchase no ore containing less than 42 per cent manganese, compared to a 35 per cent minimum in the previous schedule.

Tungsten consumption and supply were approximately the same as 1943 with some domestic producers closing down, but with output from the three major mines continuing in good quantity. Stocks during the year continued to pile up from the announced December, 1943, figure of 18,683,000 lb. of contained WO_3. Taken off allocation the first of the year, tungsten's abundance further was testified by termination of premium payments to producers effective April 30 and cessation of Metals Reserve Co. buying June 30. Bolivian producers were discouraged by a cut in the FEA purchase price to $15 a unit.

Bradley Mining Co., operators of the Yellow Pine mine in Idaho, the country's largest producer, commenced operation of a treatment plant at Boise. A plant at Salt Lake City, operated by United States Vanadium Corp. for government account, to treat low-grade concentrates ceased operations because of abundance of tungsten and a concurrent shortage of necessary acid and parts.

Molybdenum production dropped about 15 per cent from the 1943 total of 58,726,000 lb. By far the largest producer, contributing from 60 per cent to 75 per cent of the total, was the Climax mine in Colorado. Most of the remainder was a by-product of the porphyry copper mines of the far west, with some coming from U. S. Vanadium's' Bishop, Calif., tungsten operation, and a small percentage from one or two minor producers. Principally a domestic proposition, the supply was further augmented by shipments from Braden Copper Co., in Chile and from the Gran Cananea copper mine, just across the Mexican border. Molybdenum was removed from allocation the first of the year.

With stocks far over the 3,000,000 lb. goal originally set by WPB, no one was unhappy when domestic vanadium production dropped about 20 per cent from the 1943 record of 3,497,000 lb. all of it from Colorado and Utah mines. Imports, which were lower than in 1943, amounted to about two-thirds of domestic production. Withdrawal by the government from the vanadium scene was signalized by halting of purchases by Metals Reserve Co. on Feb. 28.

Nickel production during the year shadowed supply, just as it had since the beginning of the war. The bulk of world production continued to come from the International Nickel Co.'s Sudbury, Ont., deposits, which in 1943 produced 265,000,000 lb. which, in turn, represented an increase of 55,000,000 lb. over 1939, when higher grade ores were more readily available. International Nickel also refined a small volume from other mines, so that their total 1943 production amounted to about 300,000,000 lb.

Nicaro Nickel Co., a Freeport Sulphur subsidiary, began production in the Oriente province of Cuba and at its plant in Wilmington, Del., under government operating contract early in the year. The amount produced was not sufficient to improve the overall supply picture. Additional small imports from New Caledonia helped out, but there were strong hints that this would be diverted to other Allies.

Because of the concentration of supplies in this hemisphere, lend-lease commitments continued to be an important factor, one which would prevent any large scale increase in civilian supply until after completion of the Japanese war.

No information concerning the state of repair of the Petsamo mines when they were recovered by Russia from Finland has been made public but it may be conjectured that it was not good. It presumably made available to the Russians an annual supply of at least 2,000,000 lb.

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FEATURE CONTINUATION

Machine Tools

(CONTINUED FROM PAGE 180H)

year ended, the policy of the price adjustment boards as regards renegotiation on 1943 business was still not clear. Only one company had actually accepted a "voluntary" settlement on 1943 sales. Renegotiation of 1942 business reduced net profits in the machine tool industry after all charges to 5.1 per cent of gross sales, of which 1.5 per cent is in the form of an unrealized postwar refund on taxes. Hopes of more favorable treatment on 1943 net faded with the election returns. Tax relief is also being sought so that surpluses can be built up to weather the decline in volume bound to follow the close of the war and the freeing of surplus machinery. On the whole, the industry had a 20 per cent lower rate of income before Federal taxes in 1943 than in 1942.

Foreign Markets

There is some surcease from postwar headaches in foreign markets. Toward the end of 1944, neutral Sweden and Switzerland began inquiring for American machine tools for the first time since the war started. French and Belgian missions are setting up purchasing missions again, although earlier estimates of the needs of both these countries are being discounted. The Germans pulled out of both countries so fast in the summer of 1944 that they had little time to destroy or remove much industrial equipment. The story is different in Italy, but that blighted country is without funds. France is said to have large balances to its credit in this country.

For the present this business is in the inquiry stage. Only Lend-Lease commitments are being given ratings and the Russians are the only ones getting tools on Lend-Lease now. The British, on the contrary, are dickering about the disposition of some $110,000,000 worth of Lend-Lease tools on their surplus list. They would like to turn them over to British manufacturers but contend they should be charged only half the estimated value of the tools because British machine tools formerly sold for about half the price of American tools. Under existing terms of Lend-Lease none of these machines can be resold into world markets without the consent of the United States and under no circumstances shall any of these tools ever be resold into the American markets.

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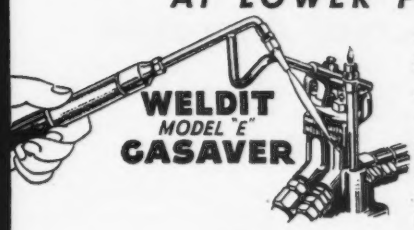

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SCRAP

. . . News and Market Activities

Home Scrap Consumption Grows in 1944

Washington

• • • **Based upon Bureau of Mines'** reports, with the closing weeks of the year estimated, the Institute of Scrap Iron & Steel, Inc., Washington, reports that total consumption of scrap in 1944 was approximately 54,876,000 gross tons, close to the 55,045,000 gross tons melted in 1943. This scrap was charged with an estimated 54,796,000 gross tons of pig iron into steel furnaces and foundry cupolas.

The consumption of scrap in 1944 included 23,324,000 gross tons of purchased scrap, while 31,552,000 tons was home scrap generated in steel mills and foundries in the process of manufacturing, and consumed on the premises. This represents a small decline from 1943 for purchased scrap and an equivalent increase in home scrap. Of the purchased scrap melted in 1944, about 8,500,000 tons originated in metalworking factories as the by-product of fabricating processes. About 15 per cent of all finished steel winds up as scrap from fabrication and manufacturing, although in some materials of war the processing loss exceeds 60 per cent.

The railroads produced scrap from rolling stock and track material replaced to the extent of 3,300,000 tons in 1944. Excepting about 500,000 tons from inventory, the remaining 11,000,000 tons of purchased scrap consumed in 1944 originated with scrap dealers in their routine collections. Scrap dealers also processed a substantial proportion of the 11,800,000 tons of scrap which originated in factories and on railroads.

In 1917, peak year of World War I, total consumption of scrap at 26,800,000 gross tons was slightly less than one-half of the volume of 1944. In 1937, the record peacetime year, the consumption of 38,000,000 gross tons was only 70 per cent of the 1944 record. Since Pearl Harbor 163,600,000 gross tons of iron and steel scrap have been used in steel mills and foundries.

Chicago Gets West Coast Allocation

Chicago

• • • **Allocation of more than** 60,000 tons of West Coast shipyard plate scrap has been made to two mills in this region with shipments to be made on government bill of lading over the next six months.

This allocation is the first from the Coast since before scrap prices softened late last summer, approximately 200,000 tons having been shipped between January and August. Unprepared scrap will be shipped in gondola cars, many of which have been returning empty from the Coast recently.

Although unprepared shipyard scrap has sold on the Coast for as low as $9.77 per gross ton in recent weeks, allocations from California take the ceiling price of $12.77 per gross ton f.o.b. cars at the shipyards. Land grant rate freight charges will amount to slightly more than eight dollars per gross ton, depending on point of origin, landing the material here at approximately $21 per gross ton unprepared. This is $1.25 over the ceiling price for railroad heavy melting steel, prepared. Much of the coast plate scrap can be charged with a minimum of preparation, but where preparation is necessary charges of $3.50 per ton additional must be taken into account.

The allocation will have the effect of causing great disinterest in whatever action Interstate Commerce Commission may take on an application reported last week to set up a temporary rate of $10 per ton on West Coast shipyard plate scrap to mills in this district. In the past Coast mills have shown opposition to application of land grant rates to scrap shipped to the Midwest from the Coast, pointing out that such rates are not accorded them on shipments from the Pacific Northwest shipyards to California points.

•

PITTSBURGH — Scrap movement here is very slow due mainly to the cold weather and deep snows that have hit the area. The railroad scrap lists, just beginning to come out for January, will provide the greatest available quantity of scrap and probably will make up a large percentage of the shipments next month.

•

CHICAGO — Other than some broker buying covering heavy mill tonnages placed early in December and purchase of small tonnages by foundries, the local market is inactive. Some purchases have been made, however, by out of district mills at prices substantially confirming those previously posted. Allocation of more than 60,000 tons to local mills from West Coast shipyards is regarded as of great importance in confirming strength of ceiling prices on desirable grades.

•

BUFFALO—Winter clamped a tighter checkrein on the scrap trade last week. With new business on a hand-to-mouth basis, partly because of the customary year end lull, no test was made of current quotations. Sentiment continues bullish on the higher brackets of open hearth material, but somewhat mixed regarding the lagging lower grades. Yard operations were slowed to a crawl by the severe weather and shipments from nearby areas fell off to a trickle in the face of transportation difficulties. Consequently, mills have been obliged to dig heavily into reserves.

•

NEW YORK — Blast furnace grades have returned to ceiling this week in New York, which brings the entire list to ceiling levels. This represents the buying price based on sales to more than one eastern Pennsylvania consumer. The cold weather, holidays and labor shortages have combined to slow down shipments to a rate disheartening to local dealers who are eager to move scrap at these prices.

•

CLEVELAND — Weather has been a big factor here. Production of the yards has been cut almost in half and of course there is not enough scrap. Turnings have been sold at ceiling but without the commission, and the feeling among the dealers seems to be that January will be a good month because there is a lot of production scrap coming out. Prices will certainly not go down until operations drop off and the buyers say that when they go down this time they won't be back up and they will go lower than they were before.

•

BIRMINGHAM—Although ceilings are not yet being paid here for open hearth grades, a development at a neighboring consuming point indicates that a further advance is likely. It's reported that Atlanta now is paying the ceiling price on No. 1 and No. 2 heavy melting steel.

Going prices as obtained in the trade by IRON AGE editors, based on representative tonnages (for ceiling prices see O. P. A. schedule No. 4). Where ceiling prices are quoted they do not include brokerage fee or adjusted freight.

PITTSBURGH

Per gross ton delivered to consumer:

No. 1 hvy. melting	$20.00
RR. hvy. melting	21.00
No. 2 hvy. melting	20.00
RR. scrap rails	21.50
Rails 3 ft. and under	23.50
No. 1 comp'd sheets	20.00
Hand bdld. new shts.	20.00
Hvy. axle turn.	$18.00 to 18.50
Hvy. steel forge turn.	18.00 to 18.50
Mach. shop turn.	14.00 to 14.50
Short shov. turn.	17.00
Mixed bor. and turn.	14.00 to 14.50
Cast iron borings	15.50 to 16.00
Hvy. break. cast	16.50
No. 1 cupola	20.00
RR. knuck. and coup.	24.50
RR. coil springs	24.50
Rail leaf springs	24.50
Rolled steel wheels	24.50
Low phos. billet crops	24.45
Low phos.	22.50
RR. malleable	22.00

CHICAGO

Per gross ton delivered to consumer:

No. 1 hvy. melting	$18.75
No. 2 hvy. melting	$17.75 to 18.75
No. 1 bundles	18.75
No. 2 dealers' bndls.	17.50 to 18.25
Galv. bundles (No. 3)	13.75 to 14.25
Mach. shop turn.	10.25 to 10.75
Short shoveling turn.	11.50 to 12.00
Cast iron borings	11.50 to 12.00
Mix. bor. & short. turn.	11.50 to 12.00
Low phos. hvy. forge	23.75
Low phos. plates	21.25
No. 1 RR hvy. melting	19.25 to 19.75
Reroll rails	22.25
Cut rails, 3 ft. and under	22.25
Locomotive tires, cut	22.25 to 22.75
Cut bolsters & side frames	19.75 to 20.25
Angles & splice bars	22.25
St'dard stl. car axles	25.25 to 25.75
No. 3 steel wheels	20.75 to 21.25
Couplers & Knuckles	21.50 to 22.00
Miscellaneous rails	20.25
Agricul. malleable	21.00 to 21.50
RR. malleable	22.00
No. 1 mach. cast	20.00
No. 1 agricul. cast	20.00
Cast iron car wheels	20.00
Hvy. breakable cast.	16.50
RR. grate bars	15.25
Brake shoes	15.25
Stove plate	19.00
Clean auto cast	20.00

CINCINNATI

Per gross ton delivered to consumer:

No. 1 hvy. melting	$18.00 to $18.50
No. 2 hvy. melting	17.00 to 17.50
No. 1 bundles	18.00 to 18.50
No. 2 bundles	16.00 to 16.50
Mach. shop turn.	6.50 to 7.00
Shoveling turn.	8.00 to 8.50
Cast iron borings	8.50 to 9.00
Mixed bor. & turn.	7.00 to 7.50
No. 1 cupola cast	21.00
Hvy. breakable cast.	16.50
Low phos. plate	20.50 to 21.50
Scrap rails	20.00 to 21.00
Stove plate	16.00 to 16.50

BOSTON

Dealers' buying prices per gross ton, f.o.b. cars

No. 1 hvy. melting	$15.05
No. 2 hvy. melting	15.05
Busheling	15.05
No. 1 and 2 bundles	15.05
Turnings, shovelings	$8.50 to 9.50
Turnings, regular	6.50 to 7.50
Mixed bor. & turn.	6.50 to 7.50
Clean cast, chem. bor.	13.06 to 14.15
Delivered to fdry. per gr. ton	
Breakable cast	21.57 to 21.87
Stove plate	20.00 to 23.51
Machinery cast, truck	21.00 to 23.51

DETROIT

Per gross ton, brokers' buying prices:

No. 1 hvy. melting	$17.32
No. 2 hvy. melting	17.32
No. 1 bundles	17.32
New busheling	17.32
Mach. shop turn.	$8.25 to 8.75
Short shov. turn.	11.25 to 11.75
Cast iron borings	10.75 to 11.25
Mixed bor. & turn.	8.25 to 8.75
No. 1 cupola cast	20.00
Charging box cast	15.50 to 16.50
Hvy. breakable cast.	15.00 to 16.00
Stove plate	18.50 to 19.00
Flashings	17.32
Low phos. plate	18.50 to 19.32
Automotive cast	20.00

PHILADELPHIA

Per gross ton delivered to consumer:

No. 1 hvy. melting	$18.75
No. 2 hvy. melting	18.75
No. 2 bundles	18.75
Mach. shop turn.	$13.00 to 13.50
Shoveling turn.	14.50 to 15.00
Cast iron borings	13.00 to 13.50
Mixed bor. & turn.	13.00 to 13.50
No. 1 cupola cast	20.00
Hvy. breakable cast.	16.50
Cast, charging box	19.00
Hvy. axle, forge turn.	18.25
Low phos. plate	21.25
Low phos. punchings	21.25
Billet crops	21.00 to 21.25
RR. steel wheels	23.25
RR. coil springs	23.25
RR. malleable	22.00

ST. LOUIS

Per gross ton delivered to consumer:

Hvy. melting	$17.50
No. 1 locomot'e tires	$17.50 to 18.00
Misc. stand. sec. rails	19.00
Railroad springs	19.50 to 20.00
Bundled sheets	17.00 to 17.50
Heavy axle turn.	14.00 to 14.50
Machine shop turns.	7.50 to 8.00
Rerolling rails	21.00
Steel car axles	21.00 to 21.50
Steel rails under 3 ft.	21.50
Steel angle bars	18.50 to 19.00
Cast iron car wheels	20.00
No. 1 machinery cast	20.00
Railroad malleable	20.00 to 20.50
Breakable cast	16.50
Stove plate	17.00
Grate bars	15.25
Brake shoes	15.25

BIRMINGHAM

Per gross ton delivered to consumer:

No. 1 hvy. melting	$16.00 to $16.50
No. 2 hvy. melting	16.00 to 16.50
No. 2 bundles	15.00 to 15.50
No. 1 busheling	13.50 to 14.00
Scrap rails	17.00 to 17.50
Rails for rerolling	19.00 to 19.50
Rails 3 ft. & under	19.00 to 19.50
Angles & splice bars	18.00 to 18.50
Long turn.	5.50 to 6.00
Cast iron borings	8.50 to 9.00
Steel axles	16.00 to 16.50
Stove plate	17.00 to 17.50
Bar crops and plate	17.00 to 17.50
Structural and plate	17.00 to 17.50
No. 1 cast	20.00 to 21.00
Cast iron carwheels	13.50 to 14.00

YOUNGSTOWN

Per gross ton delivered to consumer:

No. 1 hvy. melting	$20.00
No. 2 hvy. melting	20.00
Low phos. plate	22.50
No. 1 busheling	20.00
Hydraulic bundles	20.00
Mach. shop turn.	13.50 to 14.00
Short shovel. turn.	16.00 to 16.50
Cast iron borings	15.00 to 15.50

NEW YORK

Dealers' buying prices, per gross ton, on cars:

No. 1 hvy. melting	$15.33
No. 2 hvy. melting	15.33
Hyd. comp. black bundles	15.33
Hyd. comp. galv. bundles	13.33
Hvy. breakable cast.	16.50
Charging box cast	19.00
No. 1 cupola cast	20.00
Clean auto cast	20.00
Unstrip. motor blks.	17.50
Stove plate	19.00
Clean chem. cast bor.	14.33
Mach. shop turn.	10.33
Mixed bor. & turn.	10.33

BUFFALO

Per gross ton delivered to consumer:

No. 1 hvy. melting	$19.25
No. 1 bundles	$18.50 to 19.00
No. 2 bundles	17.50 to 18.00
No. 2 hvy. melting	18.50 to 19.00
Mach. shop turn.	10.50 to 11.00
Shoveling turn.	14.25 to 14.75
Cast iron borings	11.00 to 11.50
Mixed bor. & turn.	11.00 to 11.50
No. 1 cupola cast	20.00
Stove plate	19.00
Low phos. plate	21.75
Scrap rails	20.00 to 20.25
Rails 3 ft. & under	22.75
RR. steel wheels	23.75
Cast iron car wheels	20.00
RR. coil & leaf sprgs.	23.75
RR. knuckles & coup.	23.75
RR. malleable	22.00
No. 1 busheling	18.50 to 19.00

CLEVELAND

Per gross ton delivered to consumer:

No. 1 hvy. melting	$19.50
No. 2 hvy. melting	19.50
Compressed sheet stl.	19.50
Drop forge flashings	$18.50 to 19.00
No. 2 bundles	19.50
Mach. shop turn.	14.50
Short shovel.	16.50
No. 1 busheling	19.50
Steel axle turn.	17.50 to 18.00
Low phos. billet and bloom crops	23.66
Cast iron borings	15.50
Mixed bor. & turn.	14.50
No. 2 busheling	17.00
No. 1 machine cast.	20.00
Railroad cast	20.00
Railroad grate bars.	15.25
Stove plate	19.00
RR. hvy. melting	20.50
Rails 3 ft. & under	23.00
Rails 18 in. & under	24.25
Rails for rerolling	23.00
Railroad malleable	22.00
Elec. furnace punch.	21.50 to 22.00

SAN FRANCISCO

Per gross ton delivered to consumer:

No. 1 hvy. melting	$15.50 to $16.25
RR. hvy. melting	15.50 to 16.25
No. 2 hvy. melting	14.50 to 15.25
No. 2 bales	13.50 to 14.25
No. 3 bales	9.50 to 10.59
Mach. shop turn.	7.00
Elec. furn. 1 ft., under	15.50 to 17.00
No. 1 cupola cast	19.00 to 21.00

LOS ANGELES

Per gross ton delivered to consumer:

No. 1 hvy. melting	$14.00 to $15.00
No. 2 hvy. melting	13.00 to 14.00
No. 2 bales	12.00 to 13.00
No. 3 bales	9.00 to 10.00
Mach. shop turn.	5.00
No. 1 cupola cast	19.00 to 21.00

SEATTLE

Per gross ton delivered to consumer:

No. 1 hvy. melting	$13.50
RR. hvy. melting	13.50
No. 3 bundles	11.50
Elec. furn. 1 ft., und.	$16.00 to 17.00
No. 1 cupola cast	20.00

War Production

[CONCLUDED FROM PAGE 63]

tional workers as rapidly as needed. Therefore, actual deliveries may fall below the estimated top production, which represents the maximum capacity based on an increased labor force.

The Production Executive Committee of the WPB has placed brass mills on the National Production Urgency list to obtain priority referrals on additional manpower. Due to the short time available in which to bring production up to meet the requirements, the cooperation and combined efforts of the mills, their workers and the government are imperative.

Heavy ammunition requirements will be centered largely in shells for the five principal artillery weapons, the 60 mm. and 81 mm. mortars, the 105 mm. howitzer and the 90 mm. and 155 mm. guns. This program will require some $300,000,000 of new facilities.

The estimated surplus of refined copper for the first six months of 1945 has been reduced from 87,400 to 47,200 tons because requirements have risen 110,200 tons but supply through additional imports has been increased by only 70,000 tons. Furthermore, brass mill requirements for refined copper will rise even more sharply during the last six months of 1945 due to increasing requirements for ammunition strip.

The 1945 position of each copper controlled material form follows:

1. *Brass Mill Alloy Strip*—Estimated deliveries for the first quarter have been increased by 180,000,000 pounds and for the second quarter by 300,000,000 pounds to totals of 900,000,000 pounds and 1,020,000 pounds respectively. These estimates are possible of fulfillment only if additional manpower is obtained. As a result, alloy strip will be extremely critical.

2. *Brass Mill Alloy Rod*—Alloy rod, which has been relatively tight in 1944 will be even tighter in 1945 due to increased requirements for the artillery ammunition program and to manpower shortages.

3. *Brass Mill Alloy Tube*—Al tube in the larger sizes, seamless t ing .008" and lighter wall thickn will be extremely critical because both facility and manpower shorta All tube will be relatively tight.

4. *Brass Mill Copper Product* Brass Mill Copper products will in short supply because of the ov all brass mill manpower situation.

5. *Wire Mill Products*—Milita assault and communication wires ha become extremely critical. Producti of other wire mill products is gener ly in balance with requirements.

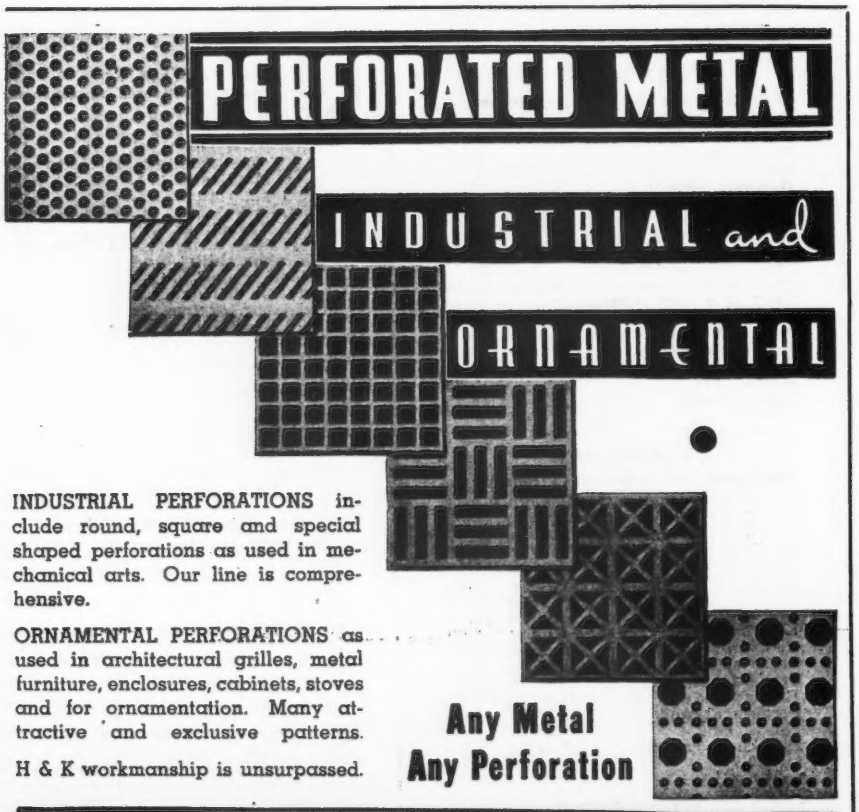
6. *Foundry Products*—Except f some difficulty in obtaining int cate castings which must meet rig tests, production is adequate to me all approved programs.

Other Metals

Current aluminum ingot producti continues at about 50 per cent capacity indicating a relatively ea situation throughout 1945. Howeve increasing aircraft demand for lar planes has placed a heavy strain facilities for aluminum sheet a heavy extruded products. Magnesiu is in about the same position.

Lead is becoming more critical u der the strain of the ammunition pr gram but contemplated diversion supply from civilian uses will assu satisfactory stockpiles for war need

The magnitude of the job that li ahead in 1945 dwarfs anything th has been accomplished to date. Th calls for management and workers "go down the line" for the war effo with all other considerations brushe aside. Only by their combined effort will it be possible to meet the expan ing needs of our armed forces.



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Luria Brothers Reorganize

Philadelphia

• • • **Herbert B. Luria,** William Luria and David Luria have resigne as officers of Luria Brothers & Co Inc., scrap brokers and dealers. Joe Claster succeeds Herbert B. Luria a executive vice-president. Robert Clymer of Reading becomes directo and vice-president and the followin who have been associated with th company for over 20 years have bee elected vice-presidents: William J Luria, vice-president and director George I. Stout, Philadelphia; Joseph E. Jacobson and Amos Bowman Pittsburgh, and Herbert Biel of Chi cago. Herbert L. Luria succeeds William F. Luria as treasurer an W. L. Forebough becomes secretary.

Comparison of Prices . . .

Advances Over Past Week in **Heavy Type**; Declines in *Italics*. (Prices Are F.O.B. Major Basing Points)

Flat Rolled Steel: (Cents Per Lb.)	Jan. 2, 1945	Dec. 26, 1944	Nov. 28, 1944	Jan. 4, 1944
Hot rolled sheets	2.10	2.10	2.10	2.10
Cold rolled sheets	3.05	3.05	3.05	3.05
Galvanized sheets (24 ga.)	3.50	3.50	3.50	3.50
Hot rolled strip	2.10	2.10	2.10	2.10
Cold rolled strip	2.80	2.80	2.80	2.80
Plates	2.10	2.10	2.10	2.10
Plates, wrought iron	3.80	3.80	3.80	3.80
Stain's c.r. strip (No. 302)	28.00	28.00	28.00	28.00
Tin and Terne Plate: (Dollars Per Base Box)				
Tin plate, standard cokes	$5.00	$5.00	$5.00	$5.00
Tin plate, electrolytic	4.50	4.50	4.50	4.50
Special coated mfg. ternes	4.30	4.30	4.30	4.30
Bars and Shapes: (Cents Per Lb.)				
Merchant bars	2.15	2.15	2.15	2.15
Cold finished bars	2.65	2.65	2.65	2.65
Alloy bars	2.70	2.70	2.70	2.70
Structural shapes	2.10	2.10	2.10	2.10
Stainless bars (No. 302)	24.00	24.00	24.00	24.00
Wrought iron bars	4.40	4.40	4.40	4.40
Wire and Wire Products: (Cents Per Lb.)				
Plain wire	2.60	2.60	2.60	2.60
Wire nails	2.55	2.55	2.55	2.55
Rails: (Dollars Per Gross Ton)				
Heavy rails	$40.00	$40.00	$40.00	$40.00
Light rails	40.00	40.00	40.00	40.00
Semi-Finished Steel: (Dollars Per Gross Ton)				
Rerolling billets	$34.00	$34.00	$34.00	$34.00
Sheet bars	34.00	34.00	34.00	34.00
Slabs, rerolling	34.00	34.00	34.00	34.00
Forging billets	40.00	40.00	40.00	40.00
Alloy blooms, billets, slabs	54.00	54.00	54.00	54.00
Wire Rods and Skelp: (Cents Per Lb.)				
Wire rods	2.00	2.00	2.00	2.00
Skelp	1.90	1.90	1.90	1.90

Pig Iron: (Per Gross Ton)	Jan. 2, 1945	Dec. 26, 1944	Nov. 28, 1944	Jan. 4, 1944
No. 2 fdy., Philadelphia	$25.84	$25.84	$25.84	$25.84
No. 2, Valley furnace	24.00	24.00	24.00	24.00
No. 2, Southern Cin'ti	25.11	25.11	25.11	23.94
No. 2, Birmingham	20.38	20.38	20.38	20.38
No. 2, foundry, Chicago†	24.00	24.00	24.00	24.00
Basic, del'd eastern Pa.	25.34	25.34	25.34	25.34
Basic, Valley furnace	23.50	23.50	23.50	23.50
Malleable, Chicago†	24.00	24.00	24.00	24.00
Malleable, Valley	24.00	24.00	24.00	24.00
L. S. charcoal, Chicago	37.34	37.34	37.34	37.34
Ferromanganese‡	135.00	135.00	135.00	135.00

†The switching charge for delivery to foundries in the Chicago district is 60c. per ton.
‡For carlots at seaboard.

Scrap: (Per Gross Ton)				
Heavy melt'g steel, P'gh.	$20.00	$20.00	$18.25	$20.00
Heavy melt'g steel, Phila.	18.75	18.75	15.50	18.75
Heavy melt'g steel, Ch'go	18.75	18.75	17.50	18.75
No. 1 hy. comp. sheet, Det.	17.32	17.32	12.75	17.85
Low phos. plate, Youngs'n	22.50	22.50	19.75	22.50
No. 1 cast, Pittsburgh	20.00*	20.00*	20.00*	20.00
No. 1 cast, Philadelphia	20.00*	20.00*	20.00*	20.00
No. 1 cast, Chicago	20.00*	20.00*	20.00*	20.00

*F.o.b. shipping point.

Coke, Connellsville: (Per Net Ton at Oven)				
Furnace coke, prompt	$7.00	$7.00	$7.00	$7.00
Foundry coke, prompt	8.25	8.25	8.25	7.50

Non-Ferrous Metals: (Cents Per Lb. to Large Buyers)				
Copper, electro., Conn.	12.00	12.00	12.00	12.00
Copper, Lake	12.00	12.00	12.00	12.00
Tin (Straits), New York	52.00	52.00	52.00	52.00
Zinc, East St. Louis	8.25	8.25	8.25	8.25
Lead, St. Louis	6.35	6.35	6.35	6.35
Aluminum, Virgin, del'd.	15.00	15.00	15.00	15.00
Nickel, electrolytic	35.00	35.00	35.00	35.00
Magnesium, ingot	20.50	20.50	20.50	20.50
Antimony, Laredo, Tex.	14.50	14.50	14.50	14.50

Composite Prices . . .

Starting with the issue of April 22, 1943, the weighted finished steel price index was revised for the years 1941, 1942 and 1943. See explanation of the change on page 90 of the April 22, 1943 issue.

	FINISHED STEEL	PIG IRON	SCRAP STEEL
January 2, 1945	2.30837c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One week ago	2.30837c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One month ago	2.30837c. a Lb.	$23.61 a Gross Ton	$17.08 a Gross Ton
One year ago	2.25513c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton

	FINISHED STEEL HIGH	FINISHED STEEL LOW	PIG IRON HIGH	PIG IRON LOW	SCRAP STEEL LOW	SCRAP STEEL HIGH
1944	2.30837c., Sept. 5	2.272349c., Jan. 4				
1943	2.25513c.,	2.25513c.,	$23.61	$23.61	$19.17	$19.17
1942	2.26190c.,	2.26190c.,	23.61	23.61	19.17	19.17
1941	2.43078c.,	2.43078c.,	$23.61, Mar. 20	$23.45, Jan. 2	$19.17, Apr. 10	$22.00, Jan. 7
1940	2.30467c., Jan. 2	2.24107c., Apr. 16	23.45, Dec. 23	22.61, Jan. 2	16.04, Apr. 9	21.83, Dec. 30
1939	2.35367c., Jan. 3	2.26689c., May 16	22.61, Sept. 19	20.61, Sept. 12	14.08, May 16	22.50, Oct. 3
1938	2.58414c., Jan. 4	2.27207c., Oct. 18	23.25, June 21	19.61, July 6	11.00, June 7	15.00, Nov. 22
1937	2.58414c., Mar. 9	2.32263c., Jan. 4	23.25, Mar. 9	20.25, Feb. 16	12.67, June 8	21.92, Mar. 30
1936	2.32263c., Dec. 28	2.05200c., Mar. 10	19.74, Nov. 24	18.73, Aug. 11	12.67, June 9	17.75, Dec. 21
1935	2.07642c., Oct. 1	2.06492c., Jan. 8	18.84, Nov. 5	17.83, May 14	10.33, Apr. 29	13.42, Dec. 10
1934	2.15367c., Apr. 24	1.95757c., Jan. 2	17.90, May 1	16.90, Jan. 27	9.50, Sept. 25	13.00, Mar. 13
1933	1.95578c., Oct. 3	1.75836c., May 2	16.90, Dec. 5	13.56, Jan. 3	6.75, Jan. 3	12.25, Aug. 8
1932	1.89196c., July 5	1.83901c., Mar. 1	14.81, Jan. 5	13.56, Dec. 6	6.43, July 5	8.50, Jan. 12
1931	1.99626c., Jan. 13	1.86586c., Dec. 29	15.90, Jan. 6	14.79, Dec. 15	8.50, Dec. 29	11.33, Jan. 6
1930	2.25488c., Jan. 7	1.97319c., Dec. 9	18.21, Jan. 7	15.90, Dec. 16	11.25, Dec. 9	15.00, Feb. 18
1929	2.31773c., May 28	2.26498c., Oct. 29	18.71, May 14	18.21, Dec. 17	14.08, Dec. 3	17.58, Jan. 29

Weighted index based on steel bars, shapes, plates, wire, rails, black pipe, hot and cold-rolled sheets and strip, representing 78 per cent of the United States output. Index recapitulated in Aug. 28, 1941, issue.

Based on averages for basic iron at Valley furnaces and foundry iron at Chicago, Philadelphia, Buffalo, Valley and Southern iron at Cincinnati.

Based on No. 1 heavy melting steel scrap quotations to consumers at Pittsburgh, Philadelphia and Chicago.

MACHINE TOOLS

. . . News and Market Activities

Impact of Ammunition Needs Expected

Cleveland

• • • **Machine tool makers here toward the close of last week were awaiting the move on the part of the government to disclose complete plans on the pooling of tool orders for new ammunition needs. There were plenty of signs that this latest demand for the Armed Forces would take precedence over all other orders.**

Some sources looked for a shift in the output of less urgent business as well as possible changes in the lend-lease program of shipments. However, the main factor which will direct the future course of machine tool output will probably be the course of the war in Europe.

The grave setbacks to the Allies in past weeks will have repercussions on this side and already in some lines of industrial activity there has been a noticeable lift in tempo. That the machine tool industry will share in the effect of this impact on the home front is a foregone conclusion.

Some makers look for an intensification of not only new programs but of old ones as well with the margin of safety for the fighting forces at a higher pitch.

Urges Check on Available Machine Tools By DPC Plants

Washington

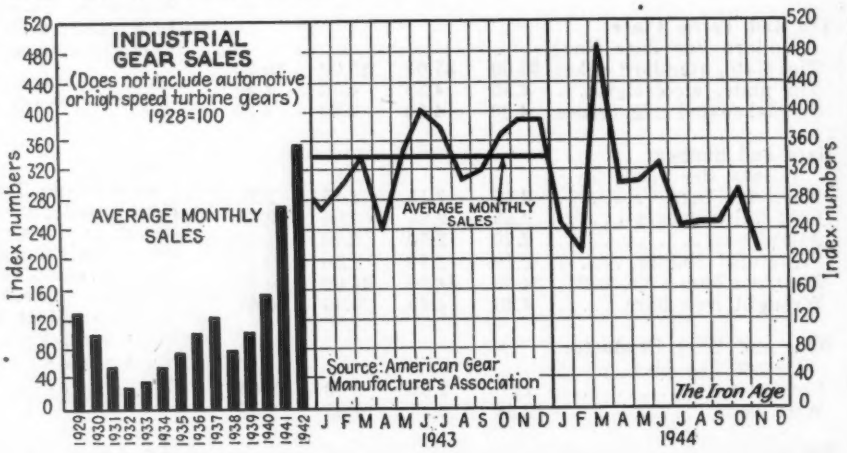
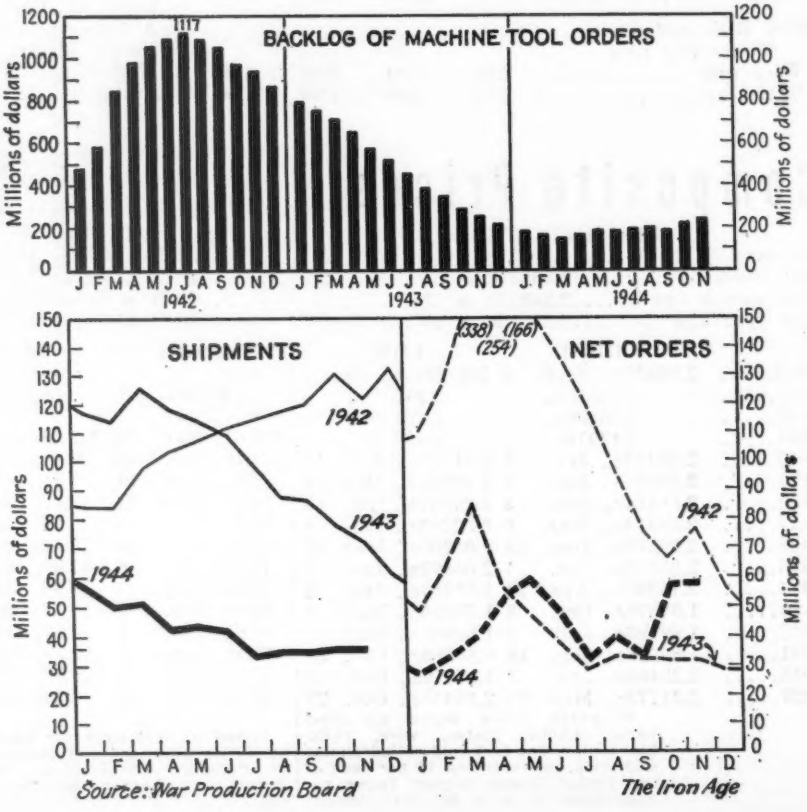
• • • **In an effort to obtain the maximum employment of machine tools in war production, Secretary of Commerce Jesse H. Jones has sent a telegram to all DPC lessees urging them to arrange for an immediate spot inventory to determine the machine tools in their possession which they can make available.**

The message said that the critical need of more ammunition and other war supplies for the fighting forces has created an urgent demand for additional machine tools and that it is vitally important that every suitable machine tool which can be made available be diverted immediately.

DPC's supervising engineer will submit to each firm a list of the types of machine tools urgently needed and will transmit to Washington.

November Gear Sales Decrease

. . . The gearing industry, as represented by the members of the American Gear Manufacturers Association, shows a decrease in volume of sales for November, as compared with October, of 28 per cent. This report does not include turbine or propulsion gearing. The index figure for November was 209.



• Machine tool shipments during November by 199 firms were valued at $36,803,000 and showed a 1.9 per cent decrease under the October shipments of $37,516,000, according to the Tools Division of WPB. Value of shipments of unrated orders was $1,403,000 during the month, WPB said. However, a decline in such shipments must be expected with the step-up of war requirements causing absorption of the unrated type of tools demands. Value of net new orders totaled $57,628,000—an increase of seven tenths of one per cent over October. The backlog of unfilled orders increased 9.4 per cent over October to $233,753,000. Approximately $107,000,000 of the $233,753,000 of unfilled orders is represented by export and unrated orders.